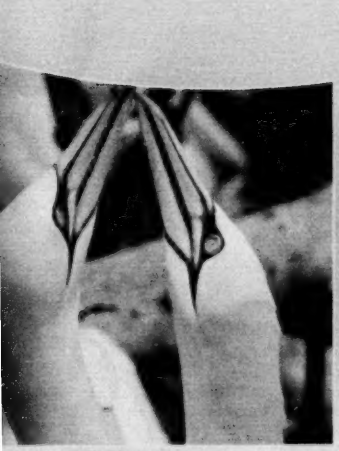
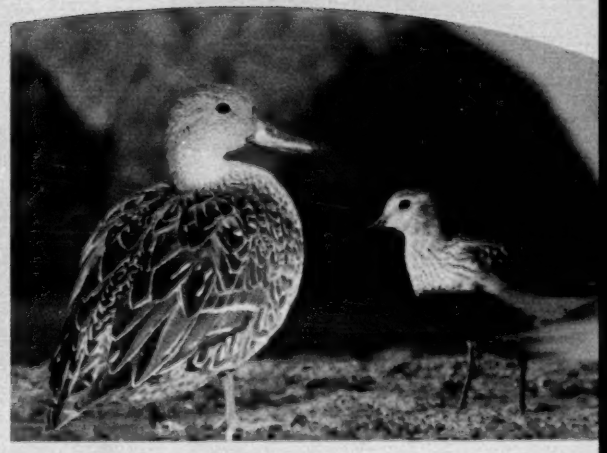
Environment Canada Environnement Canada

Bird Conservation Strategy for Bird Conservation Region 12 in Ontario and Manitoba: Boreal Hardwood Transition

June 2014





Canada

Cat. No.: CW66-318/3-2014E-PDF
ISBN 978-1-100-21069-8

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Preface

Environment Canada led the development of all-bird conservation strategies in each of Canada's Bird Conservation Regions (BCRs) by drafting new strategies and integrating new and existing plans into an all-bird framework. These integrated all-bird conservation strategies will serve as a basis for implementing bird conservation across Canada, and will also guide Canadian support for conservation work in other countries important to Canada's migrant birds. Input to the strategies from EC's conservation partners is as essential as their collaboration in implementing their recommendations.

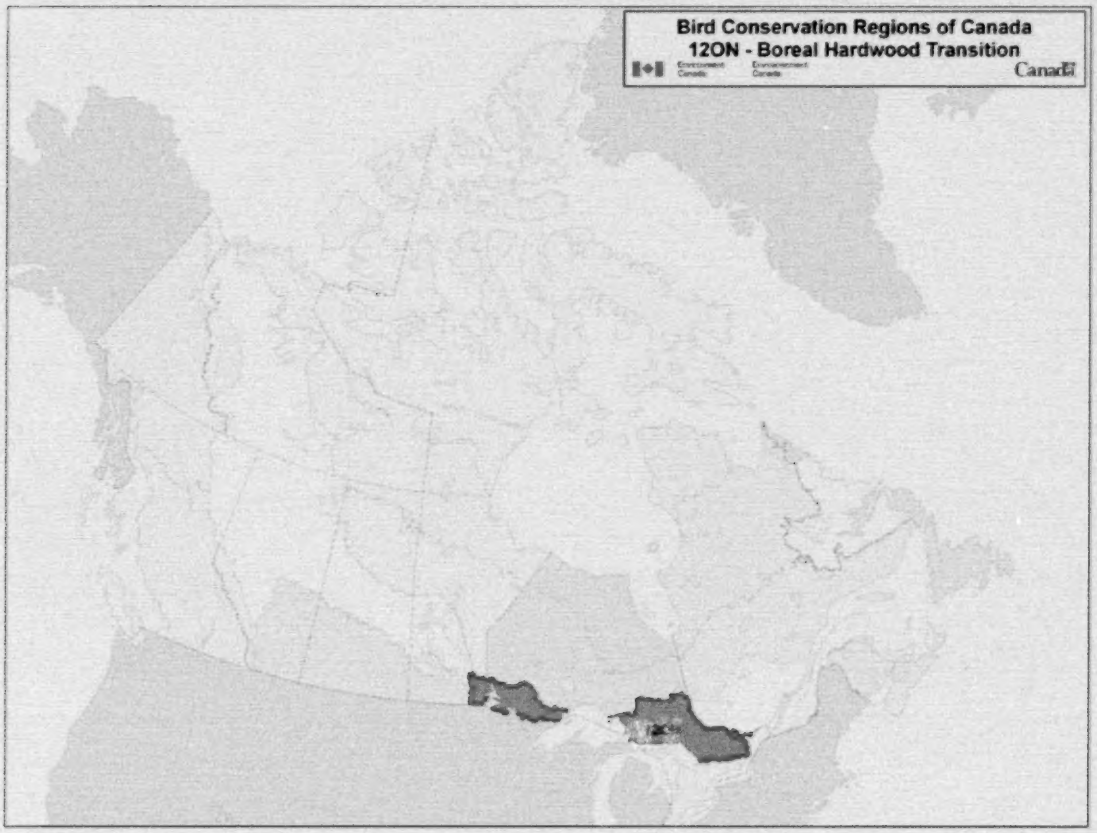
Environment Canada has developed national standards for strategies to ensure consistency of approach across BCRs. Bird Conservation Strategies will provide the context from which specific implementation plans can be developed for each BCR, building on the programs currently in place through Joint Ventures or other partnerships. Landowners including Aboriginal peoples will be consulted prior to implementation.

Conservation objectives and recommended actions in the conservation strategies will be used as the biological basis to develop guidelines and Beneficial Management Practices that support compliance with regulations under the *Migratory Birds Convention Act, 1994*. Furthermore, these strategies will guide conservation action in support of *The State of Canada's Birds 2012* (North American Bird Conservation Initiative 2012), which points to the strong influence of human activity on bird populations, both positive and negative, and presents solutions towards keeping common birds common and restoring populations that are in decline.

Acknowledgements

Brigitte Collins and Paul Smith were the main authors of this document that follows templates developed by Alaine Camfield, Judith Kennedy and Elsie Krebs with the help of the BCR planners in each of the Canadian Wildlife Service regions throughout Canada. However, work of this scope cannot be accomplished without the contribution of other colleagues who provided or validated technical information, commented on earlier draft versions of the strategy and supported the planning process. We would especially like to thank the following people: Graham Bryan, Mike Cadman, Alaine Camfield, Lesley Carpenter, Jean-Michel DeVink, Britt Dupuis, Christian Friis, Jeanette Goulet, Krista Holmes, Jack Hughes, Judith Kennedy, Sarah Mainguy, Shawn Meyer, Jocelyn Neysmith, Marie-France Noel, Michele Rodrick, Daniel Rokitnicki-Wojcik, Richard Russell, Paul Watton, Chris Wedeles, Russ Weeber, D.V. Weseloh and Scott Wilson.

Bird Conservation Strategy for Bird Conservation Region 12 in Ontario and Manitoba: Boreal Hardwood Transition



Recommended citation:

Environment Canada. 2014. *Bird Conservation Strategy for Bird Conservation Region 12 in Ontario and Manitoba: Boreal Hardwood Transition*. Canadian Wildlife Service, Environment Canada. Ottawa, ON. 152 pp + appendices.

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Executive Summary

The Boreal Hardwood Transition Bird Conservation Region, BCR 12, covers an area of about 611 300 km^2 from Quebec to Manitoba and south into the northern United States. A large portion of this region in Ontario, roughly 28% of the BCR, and a small portion in Manitoba (2%) are included in this strategy, while a separate strategy has been developed for BCR 12 in Quebec. Although reference information and data used in analyses for this strategy largely pertain to the Ontario portion of the BCR only, it was assumed to be sufficiently representative of the Manitoba portion of this BCR. These strategies will serve as a framework for implementing bird conservation nationally, and also identify international conservation issues for Canada's priority birds.

The Ontario portion of BCR 12 (BCR 12 ON) consists of a variety of forested habitats underlain by Precambrian Shield and interspersed with numerous lakes, rivers and wetlands. The region's forests are predominantly mixed, including elements of the temperate forests to the south and the boreal forests further north. The avifauna of the region reflects this transition; landbird species that are characteristic of both coniferous and deciduous forests occur here. The numerous lakes (including Lake Huron and Lake Superior), rivers and wetlands are used by a diverse assemblage of waterfowl, waterbirds and shorebirds.

Within BCR 12 ON, 260 species of birds regularly breed, overwinter, reside year-round or routinely migrate through the region.[1] Of these, 100 species are identified as priorities in this BCR. All bird groups are represented on the priority species list, although the list is dominated by landbirds (61% of the total list). The list also includes waterbirds (15%), waterfowl (17%) and shorebirds (7%). Over half of the waterfowl (55%) and waterbirds (52%) occurring in BCR 12 ON are identified as priority species, as compared to 36% of the landbirds and only 24% of shorebirds. Among the 100 priority species, 24 are assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "at risk," 18 are listed under the federal *Species at Risk Act* (SARA) and 23 are listed under Ontario's *Endangered Species Act 2007* at the time of writing this strategy.

Identifying the broad habitat requirements for each priority species within the BCR allows species to be grouped by shared habitat-based conservation issues and actions. Priority species are associated with 10 habitat types in BCR 12 ON. Wetlands are used by the greatest number of priority species (28%), while mixed, deciduous and coniferous forests are a preferred habitat type for 27%, 15% and 15% of priority species, respectively. Waterbodies, including the Great Lakes, are used extensively by 21% of priority species.

The population objectives in this strategy are categorical and are based on a quantitative or qualitative assessment of species' population trends. Much of BCR 12 ON has good coverage by large-scale bird surveys, and the status of many birds in the region is adequately known. For 31% of priority species, monitoring data suggest declines with sufficient certainty to support an

[1] Species occurrence was determined using Ontario's Breeding Bird Atlas (Cadman et al. 2007), Birds of North America Online (Cornell Lab of Ornithology 2013) and expert opinion.

objective of increasing population size. In contrast, population sizes are sufficiently large to warrant a decreasing population objective for only a single priority species: the Canada Goose, Eastern Temperate-breeding population. Maintaining populations at current levels is the objective for 25% of the priority species in BCR 12 ON, while only 12% are assigned a population objective of Assess/Maintain because monitoring data is insufficient to propose an objective. A recovery objective is assigned to 23% of priority species, all of which are species at risk. Eight (8%) percent of priority species are identified as migrating through BCR 12 ON and are not assigned an objective, as those are set in other BCR strategies covering the breeding range of these species.

An assessment of threats identified a large number and diversity of conservation issues facing priority species in the various habitats of BCR 12 ON. Major threats to priority species relate to habitat loss and degradation from a variety of sources including residential and commercial development, biological resource use, pollution, and human disturbance. The lack of biological or demographic data for some priority species are also considered as important conservation issues in this strategy.

Conservation objectives have been designed to address threats and information gaps facing priority birds in the region. Objectives for many priority species are consistent with current forest management objectives, which aim to ensure that the supply of habitat types and forest attributes in each forest management unit and ecoregion is maintained within an Estimated Range of Natural Variation (ERNV). We recognize this rigorous, science-based approach to forest management in BCR 12 ON as a dominant vehicle for conservation of birds in the region. Also important is the need to continue efforts to improve bird population and habitat monitoring to gather the missing ecological and demographic information for some priority species.

Recommended actions indicate activities that will help to achieve the conservation objectives. Actions are strategic rather than highly detailed and prescriptive. Whenever possible, recommended actions benefit multiple species and/or respond to more than one threat. The majority of actions relate to developing and implementing effective policies and regulations, promoting the development and use of Beneficial Management Practices (BMPs), increasing awareness about conservation issues, developing partnerships, improving the scientific knowledge that underlies management decisions, and improving monitoring to track the effectiveness of conservation activities. Actions to address forestry-related threats in this region seek to improve implementation of existing guidelines, or to make small modifications that benefit particular priority bird species.

Priority species in BCR 12 ON also face threats that are difficult to analyze with the standardized methodology used in this strategy. These threats include widespread issues that may sometimes not apply to a particular habitat (e.g., climate change), research needs and population monitoring, as well as threats to migratory birds when they are outside Canada. An overview of these issues, the affected species and the recommended conservation actions is also presented.

Introduction: Bird Conservation Strategies

Context

This document is one of a suite of Bird Conservation Region Strategies (BCR Strategies) that have been drafted by Environment Canada for all regions of Canada. These strategies respond to Environment Canada's need for integrated and clearly articulated conservation priorities for birds in Canada to support the implementation of its migratory birds program, both domestically and internationally. This suite of strategies builds on existing conservation plans for the four "bird groups" (waterfowl,[2] waterbirds,[3] shorebirds[4] and landbirds[5]) in most regions of Canada, as well as on national and continental plans, and includes birds under provincial/territorial jurisdiction. These new strategies also establish standard conservation planning methods across Canada and fill gaps, as previous regional plans do not cover all areas of Canada or all species of birds.

These strategies present a compendium of required actions based on the general philosophy of achieving scientifically-based desired population levels as promoted by the four pillar initiatives of bird conservation. Desired population levels are not necessarily the same as minimum viable or sustainable populations but represent the state of the habitat/landscape at a time prior to recent dramatic population declines in many species from threats known and unknown. The threats identified in these strategies were compiled using currently available scientific information and expert opinion. The corresponding conservation objectives and actions will contribute to stabilizing populations at desired levels.

The BCR strategies are not highly prescriptive. In most cases, practitioners will need to consult additional information sources at local scales to provide sufficient detail to implement the recommendations of the strategies. Tools such as BMPs will also be helpful in guiding implementation. Partners interested in implementation, such as those involved in the habitat Joint Ventures established under the North American Waterfowl Management Plan (NAWMP), are familiar with the type of detailed implementation plans required to coordinate and undertake on-the-ground activities.

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[2] NAWMP Plan Committee 2004.
[3] Milko et al. 2003.
[4] Donaldson et. al. 2000.
[5] Rich et al. 2004.

Strategy Structure

Section 1 of this strategy presents general information about the BCR and the subregion (i.e., Ontario's portion of the BCR), with an overview of the six elements[6] that provide a summary of the state of bird conservation at the subregional level. Section 2 provides more detail on the threats, objectives and actions for priority species grouped by each of the broad habitat types in the subregion. Section 3 presents additional widespread conservation issues that are not specific to a particular habitat or were not captured by the threat assessment for individual species, as well as research and monitoring needs, and threats to migratory birds while they are outside Canada. The approach and methodology are summarized in the appendices, and details are available in a separate document (Kennedy et al. 2012). A national database houses all the underlying information summarized in this strategy and is available from Environment Canada.

[6] The six elements are: Element 1– priority species assessment; Element 2 – habitats important to priority species; Element 3 – population objectives; Element 4 – threat assessment; Element 5 – conservation objectives; Element 6 – recommended actions.

Characteristics of Bird Conservation Region 12: Boreal Hardwood Transition

The Canadian portion of the Boreal Hardwood Transition, BCR 12, lies in the southern portion of the Canadian Shield and extends from Quebec to Manitoba (Fig. 1) The region covers 611 300 km², with a large fraction (170 868 km², 28%) in Ontario (Ontario Partners in Flight 2008). The Ontario portion of BCR 12 (BCR 12 ON) represents approximately one fifth (17%) of the land area of the province and occurs in two disjunct sections. The larger southern section extends from the eastern shore of Georgian Bay and Lake Superior to the Ottawa River (and then on to Quebec). The western section extends from the western shore of Lake Superior to southeastern Manitoba. Both sections of BCR 12 ON and the approximately 12 000 km² in Manitoba are included in this strategy. However, it should be noted that reference information and data used in analyses for this strategy largely pertain to the Ontario portion of the BCR only and were assumed to be sufficiently representative of the Manitoba portion of this BCR. Similarly, recommended conservation objectives and actions were assumed to apply in Manitoba's BCR 12 landscapes. A separate strategy has been developed for BCR 12 in Quebec (Environment Canada 2013d).

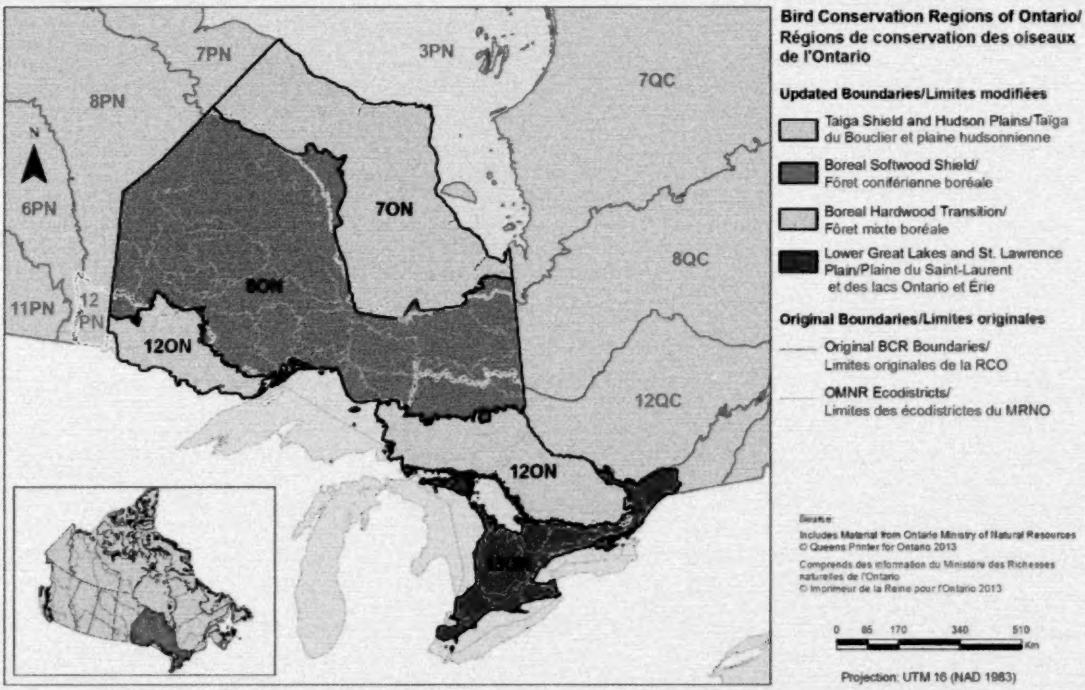

Figure 1. Map of boundary changes to Ontario's Bird Conservation Region 12: Boreal Hardwood Transition.

For conservation planning purposes, the original NABCI-defined boundaries of Ontario's BCR boundaries have been slightly modified to align with the Ontario Ministry of Natural Resources Ecodistrict boundaries.[7]

[7] Ecodistrict 4S-3 has been included in BCR 12 while 4S-1 and 4S-2 remain in BCR 8. Ecodistrict 6E-17 was placed in BCR 13, resulting in Cockburn and St. Joseph Islands being included in BCR 13 rather than BCR 12.

The physiography of the region is dominated by the Precambrian Shield, with rugged, rocky terrain and varied topography. Several areas of notable elevation include the Algonquin highlands in the southeast of the region, the peaks in Temagami including Ishpatina Ridge and Maple Mountain, the Algoma Highlands east of Lake Superior, and the Nor-Westers west of Lake Superior. The region shows evidence of extensive glacial activity; exposed bedrock, thin soils, and glacial till are common throughout BCR 12 ON. The natural landscape of this region is a mosaic of deciduous, mixed and coniferous forest stands interspersed with open wetlands, riparian meadows and rock barrens. Lakes, rivers and streams are also common within the forest matrix (Fig. 2, Table 1).

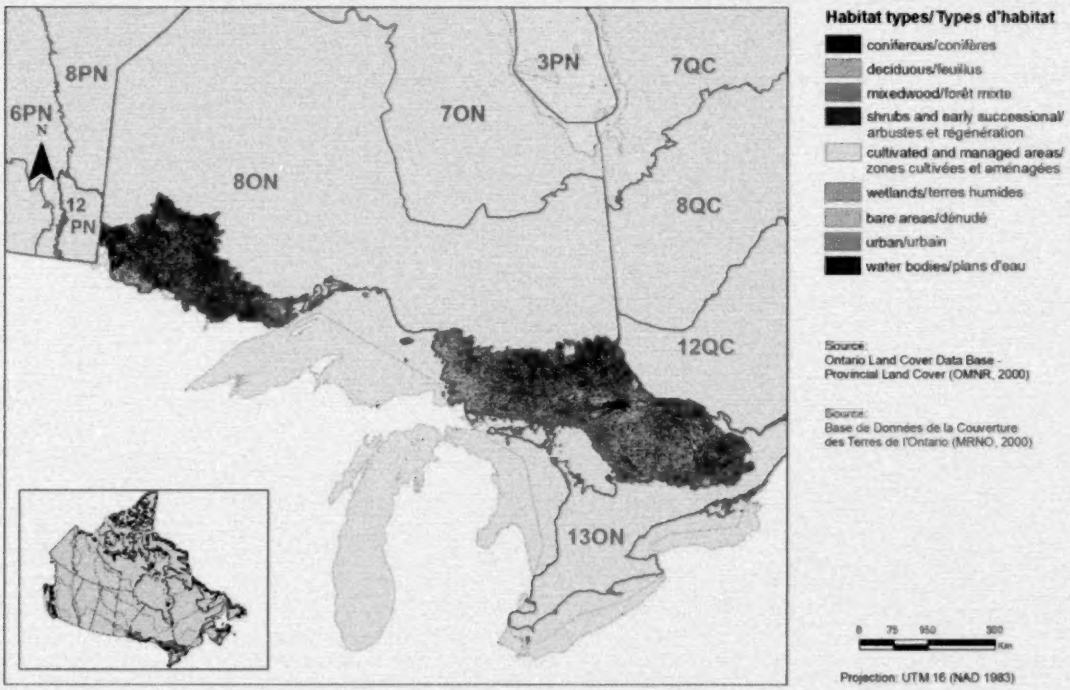

Figure 2. Map of land cover in BCR 12 ON.
Note: Riparian habitat areas are not depicted on this map because they represent a "zone" and are not a true land cover class. A map depicting the extent of derived riparian areas for illustration purposes can be found in the Riparian section of this strategy.

Table 1. Major categories of land cover in BCR 12 ON and their proportions on the landscape.

BCR Habitat Class[1]	Provincial Land Cover (PLC 27 Class(es)	Area (ha)	% of Total Area
Coniferous Forest	Forest – Dense Coniferous	2 389 646	13.99%
Deciduous Forest	Forest – Dense Deciduous	2 679 992	15.68%
Mixed Forest	Forest – Dense Mixed Forest – Sparse	7 819 472	45.76%
Shrub/Early Successional	Forest Depletion – Cuts Forest Depletion – Burns Forest – Regenerating Depletion	443 054	2.59%
Cultivated/Managed Areas	Agriculture – pasture/abandoned fields Agriculture – cropland	385 825	2.26%
Bare Areas	Sand/Gravel/Mine Tailings Bedrock Coastal shoreline[2]	233 668 44 807	1.37% N/A
Urban	Settlement / Infrastructure	124 883	0.73%
Wetlands[3]	Marsh – inland Swamp – deciduous Swamp – coniferous Fen – open Fen – treed Bog – open Bog – treed	404 614	2.37%
Waterbodies	Water – deep clear Water – shallow/sedimented	2 502 402	14.65%
Riparian[4]	30 m inland from shoreline	661 489	N/A
Unknown	Unknown, Cloud/shadow	103 325	0.60%
	Total Area	**17 086 881**	**100%**

Data source: Spectranalysis Inc., 2004 (Provincial Land Cover (PLC) 27)

[1] BCR Habitat Classes are based on the United Nations Food and Agriculture Organization (2000) international Land Cover Classification System (LCCS).

[2] Length of coastal shoreline is 18 961km (based on Natural Resource and Values Information System [NRVIS] drainage scale mapping range of 1:10 000 for southern Ontario and 1:20 000 for the near north). Coastal shoreline area is defined as: 30 m of land adjacent to large body of water – eastern Georgian Bay, North Channel, Lake Nipissing, St. Mary's River, portion of eastern and western Lake Superior and Lake of the Woods. Coastal shoreline areas are not included in the total area as they are "zones" and do not represent a true provincial land cover class.

[3] Coastal wetlands are not differentiated at the resolution of PLC data.

[4] Riparian areas are not included in the total area as they are "zones" and do not represent a true provincial land cover class.

This heavily forested region marks the transition from the temperate forests of the south to the conifer-dominated boreal forests further north (Fig. 2). Forests in BCR 12 ON are a mosaic of deciduous, mixed and coniferous stands (Ontario Ministry of Natural Resources 2002), with species such as sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), and red oak (*Quercus rubra*) common in the southeast of the region, and boreal species such as black spruce (*Picea mariana*), white birch (*Betula papyrifera*), and jack pine (*Pinus banksiana*) more common in the north. The avifauna reflects this gradient of habitats; bird diversity in BCR 12 ON is high by Canadian standards (Ontario Partners in Flight 2008), with predominantly boreal species common in the north, and species characteristic of deciduous forests in the southern extent of the region.

BCR 12 ON is also characterized by the presence of numerous lakes, rivers, streams and wetlands (Fig. 2). These diverse aquatic habitats support a wide variety of waterbirds and waterfowl. Swamps are widespread and common throughout the region, and a number of large inland lakes (e.g., Lake of the Woods) are important for breeding colonial waterbirds. The aquatic habitats in the region are also of great importance to migrants. The coastal wetlands, beaches and nearshore waters of the Great Lakes are migratory stopovers for many waterfowl, shorebirds and waterbirds. Although used extensively by a number of bird species, non-forested upland habitats such as alvars, natural prairie, rock barrens and human-altered habitats are significantly less common here than in BCR 13 to the south and BCR 11 to the west in Manitoba.

Over 10% of the land base in BCR 12 ON is specifically managed as conservation lands, which include national parks, provincial parks, conservation reserves and one National Wildlife Area (Eleanor Island). The three largest Ontario provincial parks, namely Algonquin, Lake Superior and Quetico, when taken together, ensure the conservation and protection of over 8% of the landscapes in this portion of the BCR (Fig. 3).

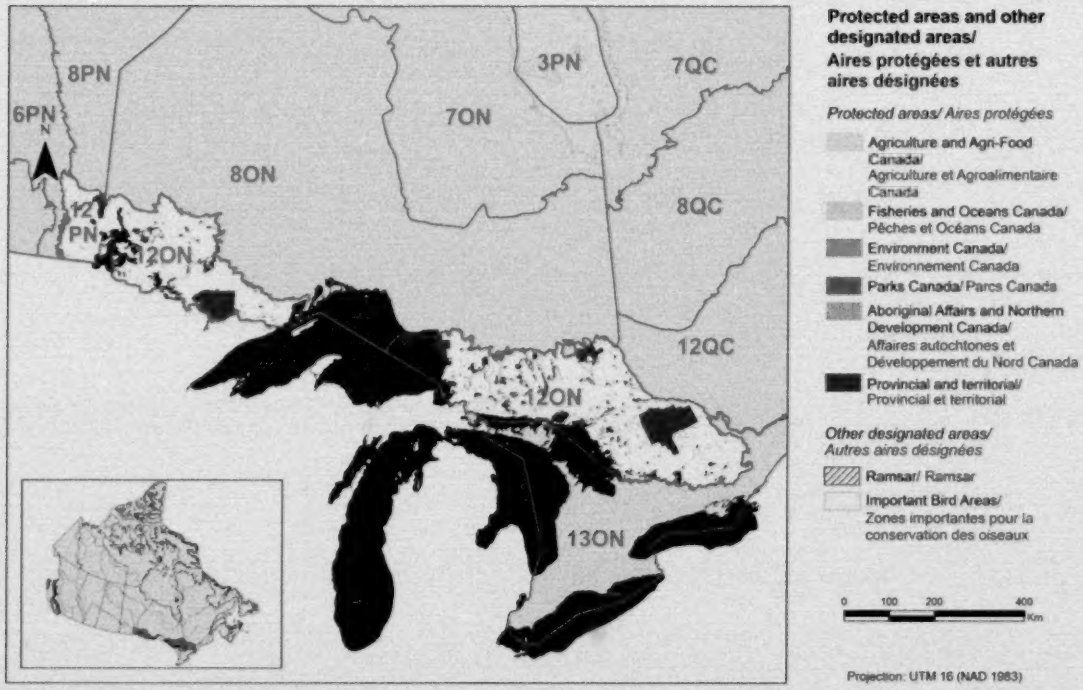

Figure 3. Map of protected and designated areas in BCR 12 ON.
Note: This figure does not reflect the updated boundaries of BCR 12 ON (see Figure 1).

Human settlements, agriculture and other forms of development are sparsely distributed across the region, in stark contrast to the highly developed BCR 13 to the south. However, humans have still had a pronounced effect on habitats throughout the region through forestry activities. Historically, Aboriginal peoples altered forest habitats through burning and harvest of forest materials on a small scale, but large-scale alteration of these habitats began 350 years ago with the arrival of Europeans (Thompson 2000; Ontario Partners in Flight 2008). Beginning in the 1700s, large, mature white pines (*Pinus strobus*) were harvested extensively for the British square-timber trade, and although this species remains widespread in the region, large white pines have never regained their former abundance. Logging increased in intensity throughout the 19th and 20th centuries due to expanded access corridors and increased mechanization. The extensive harvest of mature timber, along with the suppression of fire, has fostered a shift away from fire-dependent, shade-intolerant conifers and towards fire-sensitive, shade-tolerant deciduous species (Carleton 2000; Ontario Partners in Flight 2008).

A large majority of BCR 12 ON is forested (75%, see Table 1), and 85% of the productive forest is owned and managed by the Crown under the *Crown Forest Sustainability Act* (Government of Ontario 1994). The Act legally requires that Crown forest in Ontario be managed to conserve healthy, diverse and productive forests and their associated ecological processes and biological diversity (Pearce 2011). Management guidelines address harvest practices from a local to a landscape level, including consideration of everything from retention of individual wildlife trees

to the distribution of age classes across a landscape. In recent years, management guidelines have been devised to emulate natural disturbance patterns and maintain forest attributes within a Simulated (or estimated) Range of Natural Variation (SRNV). The rigorous, science-based approach to forest management in BCR 12 ON is a dominant vehicle for conservation of birds in the region.

Conservation of migratory birds must occur throughout the annual life cycle and across the range. For the many long-distance migrants breeding in or passing through BCR 12 ON, conservation may only be achieved through cooperation on a hemispheric scale. Identifying key conservation priorities at this scale can be challenging, but preliminary assessments of threats throughout the annual cycle are provided in this strategy.

The goal of this strategy is to further the conservation of all birds in BCR 12 ON, and maintain or restore populations to target levels. Recent decades have already seen significant progress towards bird conservation through effective forest management planning, stewardship programs, development and adoption of BMPs, municipal and provincial land use plans, the strategic protection of lands by environmental non-government organizations, and the efforts of partnerships such as the Eastern Habitat Joint Venture. Building on past achievements and strengthening partnerships are key goals of this strategy. Indeed, implementation of the actions suggested here could only be accomplished through a broad partnership of governments, industry and other stakeholders pursuing a common goal of biodiversity conservation in BCR 12 ON.

Section 1: Summary of Results – All Birds, All Habitats

Element 1: Priority Species Assessment

Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each BCR subregion (see Appendix 1). Species that are vulnerable due to population size, distribution, population trend, abundance and threats are included as priorities because of their "conservation concern." Some widely distributed and abundant "stewardship" species are also included. Stewardship species are included because they typify the national or regional avifauna and/or because they have a large proportion of their range and/or continental population in the subregion; many of these species have some conservation concern, while others may not require specific conservation effort at this time. Species of management interest are also included as priority species when they are at (or above) their desired population objectives and require ongoing management because of their socio-economic importance as game species or because of their impacts on other species or habitats (see Appendix 2).

The purpose of the prioritization exercise is to focus implementation efforts on the species and issues of greatest significance to Ontario's avifauna. As with any priority-setting exercise, some important species may be excluded; however, the issues of importance to any excluded species are usually captured by addressing the threats identified for species that are included on the priority list. With this in mind, species present in the region only as migrants were included as priority species only when their inclusion introduced new regional conservation issues, such as the protection of migratory staging sites. Otherwise, the BCR 12 ON strategy relies on conservation actions arising from threats to other priority species to address more general conservation concerns for migrants. Tables 2, 3 and 4 outline the priority species in BCR 12 ON, the relative breakdown by bird group, and the reasons for priority status.

A total of 260 bird species occur regularly in the region, 100 of which were assessed as priority species, including 24 species assessed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as "at risk," 18 listed under the federal *Species at Risk Act* (SARA), and 23 species noted as species at risk in Ontario (as of November 2013; Ontario Ministry of Natural Resources 2013a). Landbirds show the greatest diversity in BCR 12 ON, representing nearly 66% of the candidate species list (Table 3). A large number of landbird species are uncommon or non-breeders in the region; only 36% qualified for priority status. Still, a majority of the priority species in BCR 12 ON are landbirds (61 species or 61%; Table 3). By comparison, waterbirds and waterfowl show lower diversity, but a higher proportion of these species qualified for priority status (52% and 55% respectively). The diversity of breeding shorebirds in the region is low, and although coastal beaches of the Great Lakes, wetlands and other habitats in BCR 12 ON are used by migrant shorebirds, few concentrate in large numbers within this region during migration. Only 7 shorebird species qualified for priority status, including 6 breeders and 1 migrant, the endangered *rufa* Red Knot.

Table 2. Priority species in BCR 12 ON, population objective and reasons for priority status.
Note: All assessments, listings and designations are current to November 2013. A species can be on the priority list for more than one reason.

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Subregional Concern[4]	Regional/Subregional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Landbirds								
American Kestrel	Increase				Y			
Bald Eagle	Recovery objective[6]			SC	Y			Y
Bank Swallow	Increase	T			Y			
Barn Swallow	Recovery objective	T		T	Y			
Bay-breasted Warbler	Increase				Y		Y	
Belted Kingfisher	Increase					Y		
Black-billed Cuckoo	Increase					Y		
Blackburnian Warbler	Maintain current					Y	Y	Y
Black-throated Blue Warbler	Maintain current					Y		
Black-throated Green Warbler	Maintain current					Y	Y	Y
Bobolink	Recovery objective	T		T	Y		Y	
Broad-winged Hawk	Maintain current					Y		
Brown Thrasher	Increase				Y			Y
Canada Warbler	Recovery objective[6]	T	T	SC	Y	Y	Y	
Cerulean Warbler	Recovery objective	E	SC	T	Y		Y	

[1] Assessed by COSEWIC as E, Endangered; T, Threatened; SC, Special Concern.
[2] Species listed on Schedule 1 of SARA as E, Endangered; T, Threatened; SC, Special Concern (Species at Risk Public Registry 2013).
[3] Species listed as E, Endangered; T, Threatened; SC, Special Concern on the SARO List (Ontario Ministry of Natural Resources 2013a).
[4] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[5] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[6] This species is listed under the federal SARA, and/or the provincial *Endangered Species Act 2007*; however, its federal or provincial recovery documents have not yet been finalized.

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Subregional Concern[4]	Regional/Subregional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Chestnut-sided Warbler	Maintain current					Y	Y	Y
Chimney Swift	Recovery objective[6]	T	T	T	Y		Y	
Cliff Swallow	Increase				Y			
Common Nighthawk	Recovery objective[6]	T	T	SC	Y		Y	
Common Yellowthroat	Maintain current					Y		
Connecticut Warbler	Increase				Y		Y	Y
Eastern Towhee	Increase				Y		Y	Y
Eastern Whip-poor-will	Recovery objective[6]	T	T	T	Y		Y	
Eastern Wood-Pewee	Increase	SC			Y			
Evening Grosbeak	Increase				Y			
Field Sparrow	Assess/Maintain				Y			
Golden-winged Warbler	Recovery objective[6]	T	T	SC	Y	Y	Y	
Gray Catbird	Increase				Y			
Great Gray Owl	Assess/Maintain				Y			
Kirtland's Warbler	Recovery objective	E	E	E	Y	Y	Y	
Least Flycatcher	Increase					Y		
Loggerhead Shrike (*migrans*)	Recovery objective	E	E	E	Y		Y	
Louisiana Waterthrush	Recovery objective	SC	SC	SC	Y		Y	Y
Mourning Warbler	Increase					Y	Y	Y
Nashville Warbler	Maintain current					Y		Y
Northern Flicker	Increase				Y			
Northern Goshawk	Assess/Maintain				Y			
Northern Rough-winged Swallow	Increase				Y			
Olive-sided Flycatcher	Recovery objective[6]	T	T	SC	Y		Y	

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Subregional Concern[4]	Regional/Subregional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Peregrine Falcon (*anatum/tundrius*)	Recovery objective	SC	SC	SC	Y		Y	
Prairie Warbler	Assess/Maintain				Y		Y	
Purple Finch	Increase				Y			
Purple Martin	Increase				Y			
Red Crossbill	Increase				Y			
Red-headed Woodpecker	Recovery objective[6]	T	T	SC	Y		Y	
Red-shouldered Hawk	Assess/Maintain				Y			Y
Rose-breasted Grosbeak	Increase					Y		
Ruby-crowned Kinglet	Increase				Y			
Ruffed Grouse	Maintain current					Y		
Rusty Blackbird	Recovery objective[6]	SC	SC		Y		Y	
Sedge Wren	Maintain current					Y		
Short-eared Owl	Recovery objective[6]	SC	SC	SC	Y		Y	
Song Sparrow	Increase				Y			
Swamp Sparrow	Maintain current					Y	Y	Y
Tennessee Warbler	Increase				Y			Y
Tree Swallow	Increase				Y			
Veery	Increase				Y	Y		
Vesper Sparrow	Increase				Y			
White-throated Sparrow	Maintain current					Y	Y	Y
Wood Thrush	Maintain current	T			Y		Y	
Yellow-bellied Sapsucker	Maintain current					Y		Y
Shorebirds								
American Woodcock	Increase				Y		Y	

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Subregional Concern[4]	Regional/Subregional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Killdeer	Increase				Y		Y	
Piping Plover (*circumcinctus*)	Recovery objective	E	E	E	Y		Y	
Red Knot (*rufa*)	Migrant (no BCR 12 ON population objective)	E	E	E	Y		Y	
Solitary Sandpiper	Assess/Maintain				Y		Y	
Spotted Sandpiper	Maintain current				Y		Y	
Wilson's Snipe	Assess/Maintain				Y			
Waterbirds								
American Coot	Maintain current				Y			
American White Pelican	Recovery objective			T	Y		Y	
Black Tern	Recovery objective			SC	Y		Y	
Black-crowned Night-Heron	Assess/Maintain				Y			
Caspian Tern	Increase				Y			
Common Gallinule	Assess/Maintain				Y			
Common Tern	Maintain current				Y		Y	
Great Black-backed Gull	Assess/Maintain				Y			
Green Heron	Increase				Y			
Herring Gull	Maintain current				Y		Y	
Horned Grebe (western population)	Recovery objective[6]	SC		SC	Y		Y	
Least Bittern	Recovery objective	T	T	T	Y		Y	
Red-necked Grebe	Assess/Maintain				Y			
Sandhill Crane	Assess/Maintain				Y			
Yellow Rail	Recovery objective	SC	SC	SC	Y		Y	
Waterfowl								
American Black Duck	Increase				Y		Y	

Table 2 continued

Priority Species	Population Objective	COSEWIC[1]	SARA[2]	SARO[3]	Regional/Subregional Concern[4]	Regional/Subregional Stewardship[5]	National/Continental Concern	National/Continental Stewardship
Black Scoter	Migrant (no BCR 12 ON population objective)				Y		Y	
Bufflehead	Maintain current				Y			
Canada Goose (Southern James Bay population)	Migrant (no BCR 12 ON population objective)				Y		Y	
Canada Goose (Eastern Temperate-breeding population)[7]	Decrease				Y			
Common Goldeneye	Maintain current				Y		Y	
Common Merganser	Maintain current				Y			
Greater Scaup	Migrant (no BCR 12 ON population objective)				Y			
Green-winged Teal	Maintain current				Y			
Hooded Merganser	Maintain current				Y			
Lesser Scaup	Migrant (no BCR 12 ON population objective)				Y		Y	
Long-tailed Duck	Migrant (no BCR 12 ON population objective)				Y		Y	
Mallard	Maintain current				Y		Y	
Ring-necked Duck	Maintain current				Y			
Surf Scoter	Migrant (no BCR 12 ON population objective)				Y		Y	
White-winged Scoter	Migrant (no BCR 12 ON population objective)				Y		Y	
Wood Duck	Maintain current				Y			

[7] A species of management interest due to its very high abundance.

Table 3. Summary of priority species, by bird group, in BCR 12 ON.

Bird Group	Number of Species	Percent of Total Number of Species	Number of Priority Species	Percent Listed as Priority by Bird Group	Percent of Total Number of Priority Species
Landbird	171	66%	61	36%	61%
Shorebird	29	11%	7	24%	7%
Waterbird	29	11%	15	52%	15%
Waterfowl	31	12%	17	55%	17%
Total	**260**	**100%**	**100**	—	**100%**

Table 4. Number of priority species in BCR 12 ON by reason for priority status.
Note: All assessments, listings and designations are current to November 2013.

Priority Listing[1]	Landbird	Shorebird	Waterbird	Waterfowl
COSEWIC[2]	19	2	3	0
SARA[3]	14	2	2	0
SARO[4]	16	2	5	0
National/Continental Concern	26	6	7	9
National/Continental Stewardship[5]	15	N/A	N/A	N/A
Regional/Subregional Concern[6]	44	7	15	17
Regional/Subregional Stewardship	21	N/A	N/A	N/A
Management Interest[7]	0	0	0	1

[1] A single species can be on the priority list for more than one reason.
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern).
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[6] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[7] A species of management interest due to its very high abundance.

Element 2: Habitats Important to Priority Species

Identifying the broad habitat requirements for each priority species within the BCR allowed species to be grouped by shared habitat-based conservation issues and actions (see Element 2 in Appendix 2 for details on how species were assigned to standard habitat categories). If many priority species associated with the same habitat class face similar conservation issues, then conservation action in that habitat class may support populations of several priority species. BCR strategies use a modified version of the standard land cover classes (Land Cover Classification System, LCCS) developed by the United Nations (Food and Agriculture Organization 2000) to categorize habitats, and species were often assigned to more than one habitat class.

Priority species varied widely in their use of 10 habitat types in BCR 12 ON (Fig. 4). Wetlands were used by the greatest number of priority species (28%), while mixed, deciduous and coniferous forests were a preferred habitat type for 27%, 15% and 15% of priority species, respectively. Waterbodies, including the Great Lakes, were used extensively by 21% of priority species, followed by shrub and early successional habitats, which were used by 19%.

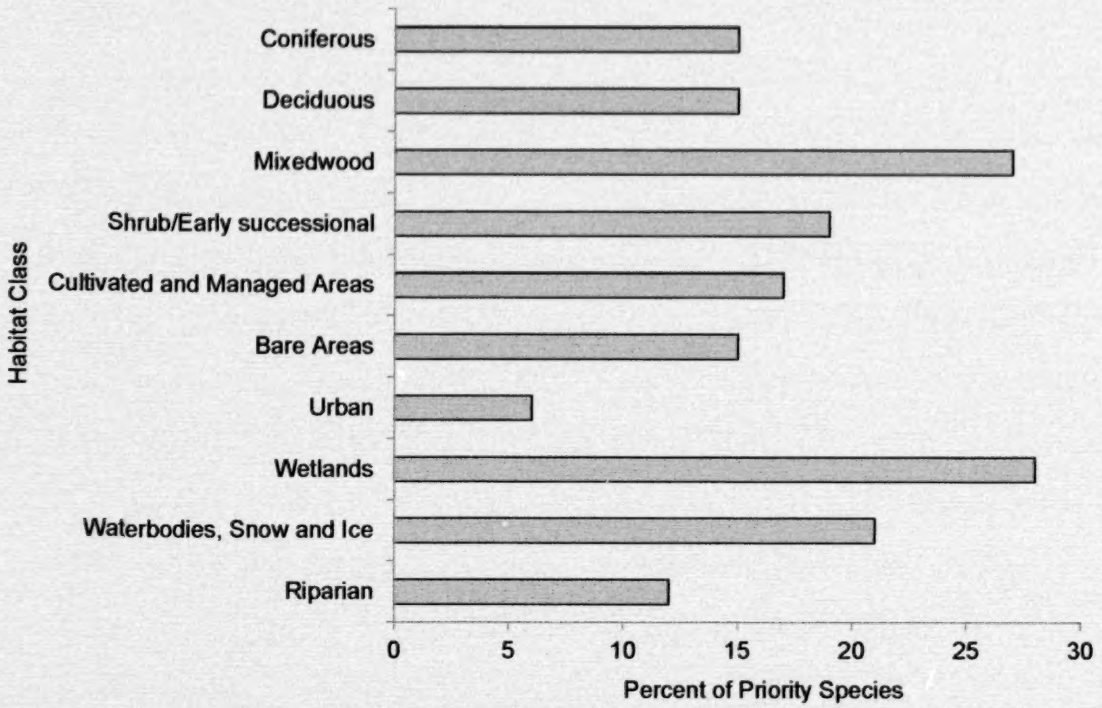

Figure 4. Percent of priority species that are associated with each habitat type in BCR 12 ON.
Note: The total exceeds 100% because each species may use more than one habitat.

Element 3: Population Objectives

Population objectives allow us to measure and evaluate conservation success. The objectives in this strategy are assigned to categories and are based on a quantitative or qualitative assessment of species' population trends. If the population trend of a species is unknown, the objective is set as "assess and maintain," and a monitoring objective is given (see Appendix 2). For any species listed under SARA or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. If recovery documents are not yet available, interim breeding population objectives are provided by species, by habitat in Section 2. When recovery objectives are available, they will replace the interim objectives. For more details on methodology, refer to Appendix 2. The ultimate measure of conservation success will be the extent to which population objectives have been reached within the timeframes set by national and continental bird conservation plans.

BCR 12 ON has good coverage by several large-scale bird surveys such as the Breeding Bird Survey, the Christmas Bird Count, the Ontario Breeding Bird Atlas, the Ontario Shorebird Survey, the Eastern Waterfowl Survey, the Great Lakes Marsh Monitoring Program and the Great Lakes Colonial Waterbird Monitoring Surveys. Consequently, in contrast to some other BCRs in Canada, data exist to evaluate the population status for a majority of species. For a large number of priority species (31%), monitoring data suggested declines with sufficient certainty to support an objective of increasing population size. Maintaining populations at current levels was the objective for 25% of the priority species in BCR 12 ON, while only 12% were assigned a population objective of Assess/Maintain because monitoring data was insufficient to propose an objective (Fig. 5).

Population objectives relating to species recovery were assigned to 23% of priority species, though many have interim objectives as mentioned above. In contrast, populations were sufficiently elevated to warrant a reduction in population size for only a single priority species: the Canada Goose, Eastern Temperate-breeding population. Priority species that were identified as migrating through BCR 12 ON were not assigned an objective (8%), as those were set in other BCR strategies covering the breeding range of these species (Fig. 5).

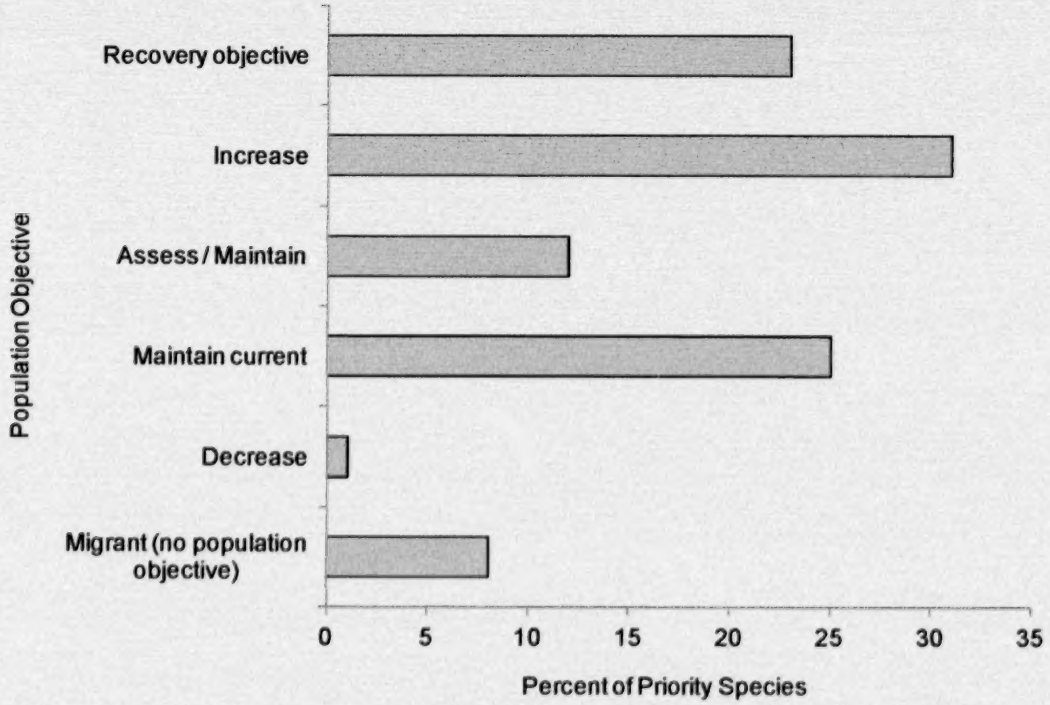

Figure 5. Percent of priority species that are associated with each population objective category in BCR 12 ON.

Element 4: Threat Assessment for Priority Species

Bird population trends are driven by factors that negatively affect either their reproduction or survival during any point in their annual life cycle. Threats that can reduce survival include, for example, reduced food availability at migratory stopovers or exposure to toxic compounds. Examples of threats that can reduce reproductive success may include high levels of nest predation or reduced quality or quantity of breeding habitat.

The threats assessment process (which is based on the methods described in Salafsky et al. 2008; see Appendix 2) identifies threats believed to have a population-level effect on individual priority species. These threats are assigned a relative magnitude (Low, Medium, High, Very High), based on their scope (the proportion of the species' range within the subregion that is impacted) and severity (the relative impact on the priority species' population). This allows us to target conservation actions towards threats with the greatest effects on suites of species or in broad habitat classes. Some well-known conservation issues may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, they merit attention in conservation strategies because of the large numbers of individual birds affected in many regions of Canada. Usually these issues transcend habitat types and are considered "widespread," and these issues are addressed in a separate section (see Section 3: Widespread Issues), but unlike other threats, they are not ranked (e.g., climate change and severe weather; threat category 11).

In BCR 12 ON, threat category 12 "other direct threats" and sub-category 12.1 "Information lacking" was used to identify priority species that lack adequate biological or demographic information required for population conservation and management. Using this category in this manner facilitated the development of targeted research and monitoring conservation actions to address knowledge gaps for these species, but unlike the other threats, they were not ranked (Fig. 6).

A large number and diversity of anthropogenic threats and other conservation issues facing priority species in the various habitats of BCR 12 ON were identified (Fig. 6 and Table 5). Major threats to priority species relate to habitat loss and degradation from a variety of sources including residential and commercial development (threat category 1), biological resource use (category 5), pollution (category 9), and human disturbance (category 6). Within BCR 12 ON, threats related to climate change and severe weather (category 11) were considered to be widespread and as such are addressed in the Widespread Issues section of this strategy.

Cumulative Effects of Threats to Priority Species

For several of the threats identified in this strategy, the long-term effects are equal to or greater than the sum of the effects of the individual threats. There is no standardized method for assessing these "cumulative effects." The threat ranking and roll-up procedures (Table 5; Appendix 2) demonstrate the sum of effects for threats within and among threat categories, and are useful for identifying the most important threats within a habitat class. These procedures also identify whether a large number of low-level threats may be affecting a

species. However, it is important to consider that threats might interact in unanticipated ways, or that in aggregate, threats might exceed some ecological threshold to produce cumulative effects of an unanticipated magnitude. Cumulative impact studies assessing population responses to multiple stressors are an important tool to better understand the long-term consequences of some of the threats described in this strategy.

Threats to priority species while they are outside Canada during the non-breeding season were also assessed and are presented in the section Threats Outside Canada.

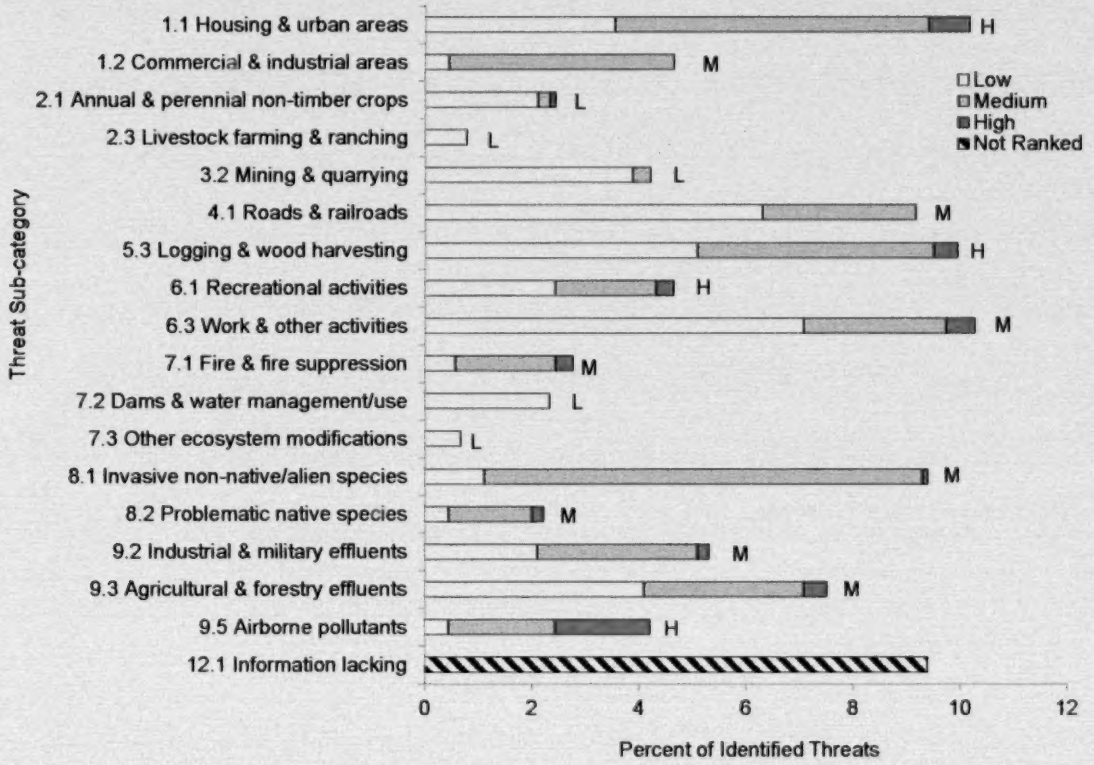

Figure 6. Percent of identified threats to priority species within BCR 12 ON by threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in BCR 12 ON (for example, if 100 threats were identified in total for all priority species in BCR 12 ON, and 10 of those threats were in the category 9.5 Airborne pollutants, the bar on the graph would represent this as 10%). Shading in the bars (H = high, M = medium and L = low) represents the magnitude of the threats in each threat sub-category in the BCR. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category). The overall rolled up magnitude of the sub-threat is shown at the end of each bar (also presented in Table 5). Threat sub-category 12.1 Information lacking was not ranked. See Element 4 in Appendix 2 for details on how magnitude was assessed).

Table 5. Relative magnitude of identified threats to priority species within BCR 12 ON by threat category and broad habitat class.

Only threats with a population-level effect were considered, and overall ranks were generated through a roll-up procedure described in Kennedy et al. (2012). L represents Low Magnitude threats, M: Medium, H: High, and VH: Very High. Cells with hyphens indicate that no priority species had population-level threats identified in the threat category/habitat combination.

Threat Category	Habitat Class										
	Coniferous	Deciduous	Mixed Wood	Shrub/Early successional	Cultivated and Managed Areas	Bare Areas	Urban	Wetlands	Waterbodies	Riparian	Overall
Overall	**M**	**H**	**H**	**M**	**M**	**H**	**M**	**H**	**H**	**M**	
1. Residential & Commercial Development	M	H	H	M	-	H	M	H	-	M	**H**
2. Agriculture & Aquaculture	-	-	-	L	M	-	-	L	-	-	**L**
3. Energy Production & Mining	-	-	-	-	-	M	-	L	-	L	**L**
4. Transportation & Service Corridors	L	L	L	L	L	-	L	M	-	M	**M**
5. Biological Resource Use	H	H	H	-	-	-	-	M	-	M	**H**
6. Human Intrusions & Disturbance	L	L	L	L	M	H	M	H	H	M	**H**
7. Natural System Modifications	M	L	M	H	-	L	-	L	L	-	**M**
8. Invasive & Other Problematic Species & Genes	M	M	M	M	L	M	-	H	M	-	**M**
9. Pollution	L	L	L	L	H	L	-	H	VH	H	**H**

Element 5: Conservation Objectives

Conservation objectives were designed to address threats and information gaps that were identified for priority species. They describe the environmental conditions and research and monitoring that are thought to be necessary for progress towards population objectives and to understand underlying conservation issues for priority bird species. As conservation objectives are reached, they will collectively contribute to achieving population objectives. Whenever possible, conservation objectives were developed to benefit multiple species and/or respond to more than one threat (see Appendix 2).

For BCR 12 ON, many conservation objectives identified relate to ensuring an adequate supply and quality of habitat (conservation objective category 1; Fig. 7). Included in these objectives are the maintenance of the full range of naturally occurring habitat types, maintaining the quality of existing habitats, and retaining important features on the landscape (e.g., standing dead snags for cavity nesting birds). Also important is the need to manage individual species (category 3). Most of the objectives in this category relate to the prevention and control of invasive and exotic species as well as the development and/or implementation of recovery strategies and management plans for species at risk in BCR 12 ON. Another frequently identified conservation objective category reflects the need to improve understanding of factors causing population declines of priority species, as well as enhancing population/demographic and habitat monitoring across the BCR (category 7). Other objectives address the need to reduce human disturbance of priority species (category 4), ensure adequate food supply through the maintenance of natural food webs and prey sources (category 5), and to reduce mortality (and/or sub-lethal effects) through reductions in pesticide (including herbicide) use across the BCR (category 2).

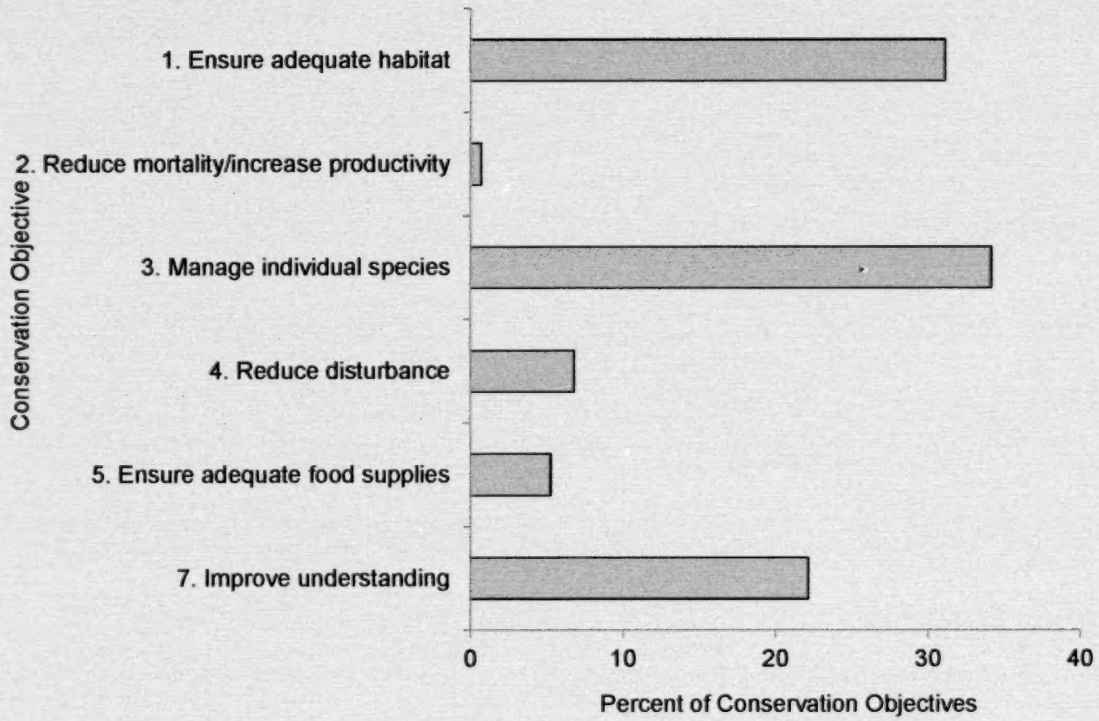

Figure 7. Percent of all conservation objectives assigned to each conservation objective category in Ontario BCR 12 ON.

Element 6: Recommended Actions

Recommended actions indicate on-the-ground activities that will help to achieve the conservation objectives (Fig. 8). Actions are strategic rather than highly detailed and prescriptive (see Appendix 2). Whenever possible, recommended actions benefit multiple species, and/or respond to more than one threat. Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level, and will usually be more general than those developed for individual species. However, for detailed recommendations for species at risk, readers should consult published federal recovery documents (Species at Risk Public Registry 2013) or provincial recovery documents (Ontario Ministry of Natural Resources 2013b). Similarly, a number of landbird species included in this strategy are stewardship species as defined by Partners In Flight (Rich et al. 2004). These are species with stable populations or for which no specific conservation issues have been identified, but which depend on BCR 12 ON to such an extent that the region has a high responsibility for their protection. These species may not appear prominently in the threats, objectives and actions described herein, but should benefit from the implementation of recommended actions that target multiple species.

A majority of conservation objectives were related to the protection or restoration of habitats, and accordingly, the more specific conservation actions also relate to this theme. Recommended actions are diverse in their approach (Fig. 8) and include developing and implementing effective policies and regulations (action sub-category 5.2), promoting the development and use of BMPs (sub-category 5.3), undertaking actions to promote awareness of issues (sub-category 4.3), improving the scientific knowledge that underlies management decisions (sub-category 8.1), improving monitoring to track the effectiveness of conservation activities (sub-category 8.2), and restoring habitat and natural processes (sub-category 2.3), driven in part by the role of fire suppression and logging practices in altering natural cycles.

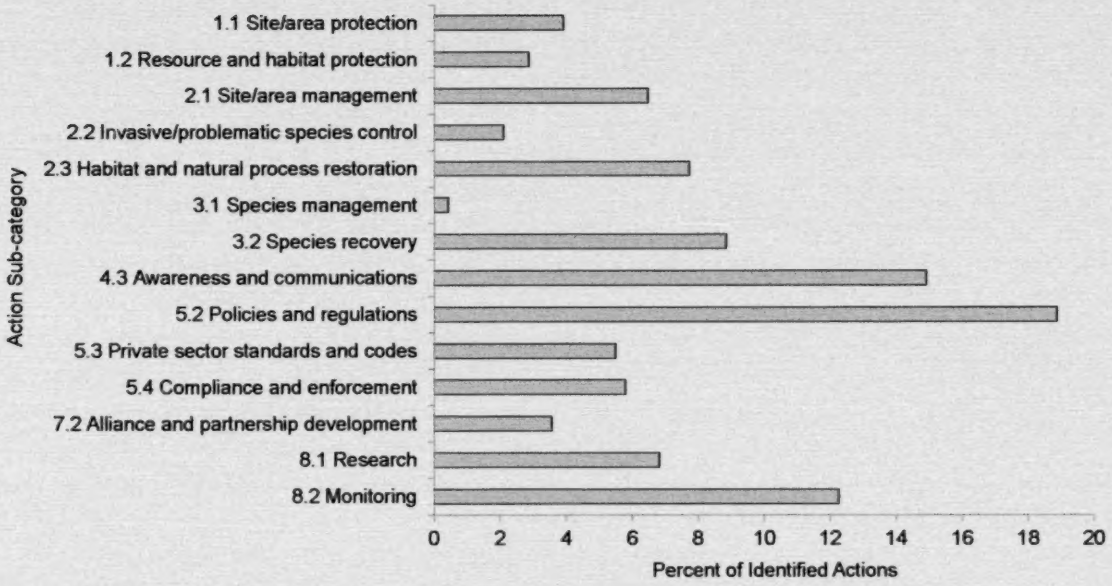

Figure 8. Percent of recommended actions assigned to each sub-category in BCR 12 ON.
"Research" and "Monitoring" actions refer to specific individual species where information is required to support conservation and management. For a discussion of broad-scale research and monitoring requirements, see the section on Research and Population Monitoring Needs (Section 3).

Section 2: Conservation Needs by Habitat

The following sections provide more detailed information on priority species, their threats and objectives, and habitat-specific issues within each of the broad habitat classes that occur in BCR 12 ON. Conservation objectives and corresponding actions have been developed to address only those threats to priority species that have a magnitude of "medium" or greater. Some species do not appear in the threats table because their low-level threats have not been assigned objectives or actions, they are migrants and no threats were identified in a specific habitat, or identified threats are addressed in the Widespread Issues section of the strategy.

The priority birds of BCR 12 ON face a variety of threats, from habitat loss and degradation, to threats of habitat shifting and alteration due to climate change. As discussed above, some of these threats apply broadly to all habitat types and are better described as "widespread issues." These issues, including collisions with vehicles and human-made structures, expansion of road networks, predation by domestic and feral cats, pollution and habitat alteration or other issues related to climate change are discussed separately in a subsequent section. It is important to note that the threats in sub-category 1.2, Commercial and industrial areas, refer mainly to collisions with buildings and towers, which is discussed under Widespread Issues, while habitat loss due to development (commercial and residential) has been included in threat sub-category 1.1, Housing and urban areas (urban development).

Forestry and Forest Management in BCR 12 ON

Three-quarters of BCR 12 ON is forested (Table 1), and more than half of the region is managed for timber production (Ontario Ministry of Natural Resources 2002, 2007; Ontario Partners in Flight 2008). Threats related to forestry affected 61 priority species (61%), and were ranked as high magnitude overall. However, it should be noted that other threats such as habitat loss and degradation from urban development, habitat degradation from pollution, and disturbance figured with similar overall prominence in the threats assessment (Table 5, Fig. 6). Forestry operations in the region are managed to accommodate the needs of birds and other wildlife, but still, forestry merits special attention in the strategy for two reasons: 1) it is the dominant human land use in the region, and 2) regulations, policies and partnerships are already in place to support and deliver effective conservation of birds through the management of forestry activities. Furthermore, in an effort to promote compliance with the *Migratory Birds Convention Act, 1994,* Environment Canada has developed avoidance guidelines that aim to reduce the risk of incidental take of migratory birds, nests and eggs by providing advice on making proactive avoidance and mitigation decisions for any activities that might affect migratory birds (Environment Canada 2013a).

In BCR 12 ON, 85% of productive forest is owned by the Crown and managed for timber production under the provincial *Crown Forest Sustainability Act* of 1994 (Pearce 2011). The Act legally requires that Crown forest in Ontario be managed to conserve healthy, diverse and productive forests and their associated ecological processes and biodiversity, through management that emulates natural disturbance and landscape patterns. Policies and regulations under the Act address the provision of habitat at a coarse and fine scale, and are

the major vehicle for management of the BCR 12 ON forest matrix. At the coarse, landscape-level scale, forest management guidelines such as *The Forest Management Guide for the Great Lakes St Lawrence Landscape* (Ontario Ministry of Natural Resources 2010a) provide direction on maintaining or enhancing natural landscape structure, composition and patterns ultimately resulting in healthy, productive forest ecosystems. The *Stand and Site Guide* (Ontario Ministry of Natural Resources 2010b) complements the Landscape Guides but is on a finer scale and meets specific societal, economic or ecological goals not well addressed by application of the coarse-level direction within the Landscape Guides.

The direction provided in the Landscape Guides seeks to emulate natural disturbance and landscape patterns, as required by the Act. In many forested ecosystems, natural disturbances such as fire and blow-downs create variability, in space and time, of forest characteristics. Silvicultural[8] practices in Ontario assume that this variability is a desirable trait, and seek to manage forests within the Simulated Range of Natural Variation or Estimated Range of Natural Variation (SRNV/ERNV). The Landscape Guide uses long-term simulation models and historical records to estimate the range of variation in major forest parameters (e.g., forest composition, age class distribution and landscape pattern; Ontario Ministry of Natural Resources 2002) at the ecoregion scale that would be expected under a regime of natural disturbance. It is assumed that managing forests to be within this range of natural variation will support the maintenance of or a return to the desired historical abundances of forest birds.

At a smaller spatial scale, the *Stand and Site Guide* (Ontario Ministry of Natural Resources, 2010b) provides specific direction to modify forest management operations to benefit birds and other wildlife. Guidelines seek to maintain tree species diversity, retain wildlife trees and downed woody material, preserve hydrologic function by minimizing soil compaction and rutting, and avoid disturbing nests or habitat of specific bird species of interest, such as birds of prey or species at risk. Collectively, guidelines at the stand and site level, the landscape level, and other policies and guidelines related to forest management offer an effective framework for the conservation of priority birds in BCR 12 ON. Actions recommended to address forestry-related threats in this region seek to improve implementation of the guidelines, make small modifications to benefit particular species, or improve the scientific understanding behind the policies.

In the boreal forests, by signing the Canadian Boreal Forest Agreement (2010), forestry companies have demonstrated a willingness to work collaboratively and proactively in order to minimise environmental impacts. This agreement between 21 major Canadian forest product companies and leading environmental non-governmental organizations covers over 70 million hectares of boreal forest across the full breadth of the country, including a portion of northern BCR 12 ON. The agreement seeks to achieve a balance between environmental protection and the competitiveness of Canada's forestry sector, for example through the suspension of forestry activities in key habitats for Boreal Caribou (a species at risk) and by seeking market

[8] Silviculture is the practice of controlling the establishment, growth, composition, health, and quality of forests to meet diverse needs and values.

recognition for progress towards sustainable forestry practices (Canadian Boreal Forest Agreement, 2010). This historic agreement demonstrates an unprecedented commitment to habitat protection on the part of the forestry sector, and could offer a model for collaboration throughout forested regions of Ontario.

Habitat-specific Issues and Actions

Coniferous

According to the United Nations Food and Agriculture Organization's Land Cover Classification Scheme (LCCS), coniferous habitats are defined as forest dominated by evergreen trees whose foliage is typically needle-shaped. Forest habitats throughout much of BCR 12 ON contain a greater proportion of deciduous species; predominantly coniferous forest accounts for only 14% of the provincial land cover of the region (Fig. 9; Table 1). This habitat is used extensively by 15 priority species, all landbirds (Table 6), including 3 species at risk: Canada Warbler, Common Nighthawk and Olive-sided Flycatcher. Blackburnian Warbler is the only coniferous forest landbird with more than 10% of its total population breeding in BCR 12 ON, and more than 20% of the global population of Purple Finch winters here (Ontario Partners in Flight 2008).

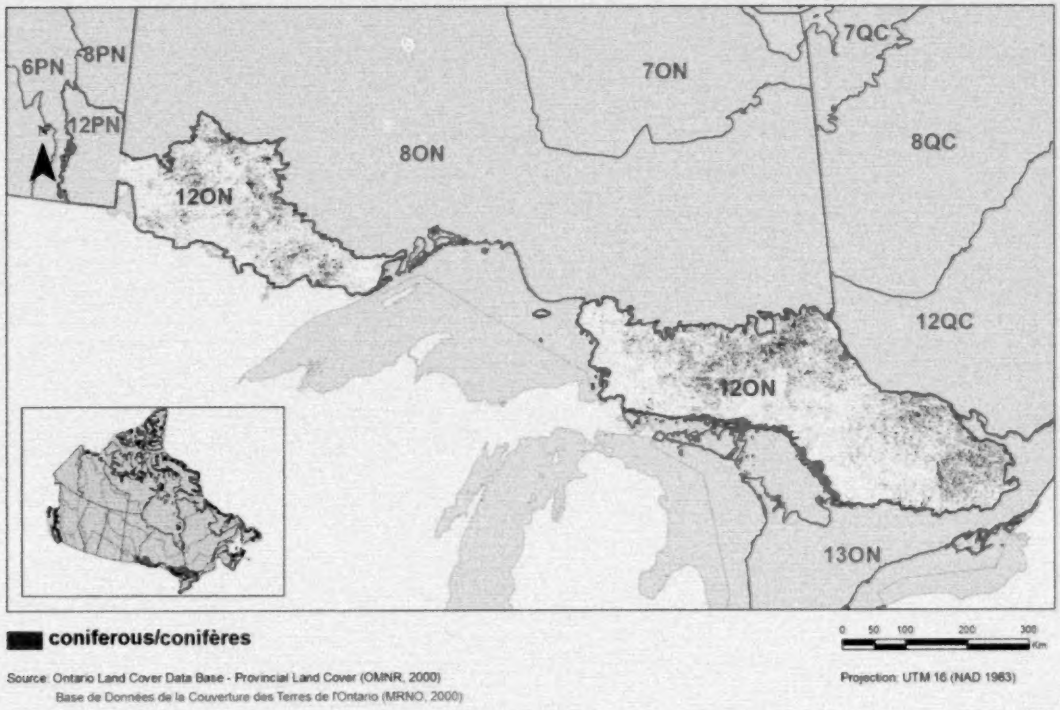

Figure 9. Map of coniferous forests in BCR 12 ON.

Coniferous forests are most common in the northern and western extent of the region, with deciduous forests more common in the south, and mixed forest the most common forest type

throughout. Lowland coniferous forests dominated by black spruce are concentrated along the northern edge of the BCR (more common in true boreal habitats farther north), dense stands of white and red pine (*Pinus resinosa*) are most common in the southeastern portion of the region, and upland coniferous forests of spruce and jack pine are found throughout (Ontario Ministry of Natural Resources 2002). The major natural disturbances in coniferous forests of the region include blow-down, fire, insect outbreaks and disease (Thompson 2000; Fleming et al. 2000). Even before wide-spread suppression of fire, large-scale, catastrophic fire was less frequent in the forests of this region than in the boreal forest further north.

Table 6. Priority species that use coniferous habitat in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Bay-breasted Warbler	Dense spruce-fir forests; Spruce budworm specialist	Increase				Y		Y	
Blackburnian Warbler	Mature to old growth coniferous forests	Maintain current					Y	Y	Y
Black-throated Green Warbler	Mature coniferous forests with complex vertical layers	Maintain current					Y	Y	Y
Canada Warbler	Relatively open stands of conifers	Recovery objective†	Y	Y	Y	Y	Y	Y	
Common Nighthawk	Relatively open stands of coniferous forest; open, young regenerating forest, clearcuts and burns	Recovery Objective†	Y	Y	Y	Y		Y	
Connecticut Warbler	Tamarack-spruce fens with well-developed understory	Increase				Y		Y	Y
Great Gray Owl	Mature coniferous forests with openings	Assess/ Maintain				Y			

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Canada Warbler: Increase; Common Nighthawk: Assess/Maintain; Olive-sided Flycatcher: Increase.

Table 6 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Nashville Warbler	Open second-growth mixed and coniferous forests, with predominantly black spruce	Maintain current					Y		Y
Northern Goshawk	Mature coniferous forests with high canopy closure, and generally low ground and shrub cover	Assess/ Maintain				Y			
Olive-sided Flycatcher	Open, coniferous-dominated forest; cutovers and burns	Recovery Objective[†]	Y	Y	Y	Y		Y	
Purple Finch	Coniferous forests with openings; Spruce budworm specialist	Increase				Y			
Red Crossbill	Coniferous forests	Increase				Y			
Ruby-crowned Kinglet	Coniferous forests	Increase				Y			
Tennessee Warbler	Early successional coniferous forests with openings; Spruce budworm specialist	Increase				Y			
White-throated Sparrow	Coniferous forests with openings and low dense vegetation	Maintain current					Y	Y	Y

Forestry was determined to be a threat of high magnitude to priority species in coniferous habitats (threat sub-category 5.3; Fig. 10) because of its negative effects on habitat supply and quality. Forestry management guidelines already consider the needs of many birds. Key aspects of management with particular importance to coniferous forest birds include (from Ontario Partners in Flight 2008):

- Harvesting prescription, patch size/configuration and rotation cycles
- Pre- and post-harvest silvicultural treatments (including prescribed fires and brush management) that affect conifer regeneration
- Amount of mature and old-growth forest
- Legacy of past forest management practices, which changed age class structure and did not retain adequate supply of important habitat features such as snags, downed woody debris, etc.
- Frequency and control of budworm and other insect outbreaks
- Fire suppression with has altered the forest composition
- Forest type conversion to reverse past conversion of pine and hemlock stands to deciduous and mixed forest types

Fire suppression (sub-category 7.1) was identified as a medium magnitude threat for two species using or found in this habitat, the Olive-sided Flycatcher and the Common Nighthawk, both species at risk. These species depend on fire for creating open areas for nesting (Common Nighthawk; COSEWIC 2007a) and foraging (Olive-sided Flycatcher; COSEWIC 2007b), and fire suppression reduces the amount and limits the distribution of burned or post-fire habitats.

Invasive non-native species were determined to have medium magnitude effects on priority species (sub-category 8.1). Outbreaks of invasive non-native forest pests and tree diseases can adversely affect forest health and habitat value. For example, the Pine shoot beetle (*Tomicus piniperda*), which is established in southern Ontario, attacks pine trees of all ages and can cause whole tree mortality in only two years (Ontario Ministry of Natural Resources 2010c). This species has recently moved from pine plantations to nearby forests and while it is not yet known as a threat in BCR 12 ON, along with other species such as the European wood wasp *(Sirex noctilio)*, it has the potential to devastate the province's forest ecosystems (Sanderson et al. 2012). Climate change, discussed in more detail in a later section, can increase the risk of outbreaks of these and other forest pests by increasing overwinter survival. For example, milder winters could facilitate further range expansion of the Mountain pine beetle (*Dendroctonus ponderosae*); projections suggest that this species, which has caused widespread devastation of western forests, could reach Ontario's pine forests by 2050 (Colombo 2008). Longer-term effects of climate change could include effects on disturbance regimes (especially fire) and tree growth rates, as local climate conditions become unsuitable for previously site-adapted species (Colombo 2008).

Mortality from collisions with buildings, communication towers or windows (sub-category 1.2) was assessed as a medium magnitude threat for priority species in coniferous forests. Given the wide-ranging nature of this threat, conservation objectives and actions are presented in the Widespread Issues section of this strategy rather than in Table 7 in this section.

The full list of threats to priority species in coniferous habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 7. Conservation objectives and actions focus on ensuring land and resource-use policies and practices maintain or improve coniferous habitats and the features that make them important for birds, as well as the prevention and control of invasive, non-native species. Research and monitoring objectives (sub-category 12.1) were also identified that focus on gathering ecological and demographic information for specific priority species in the region.

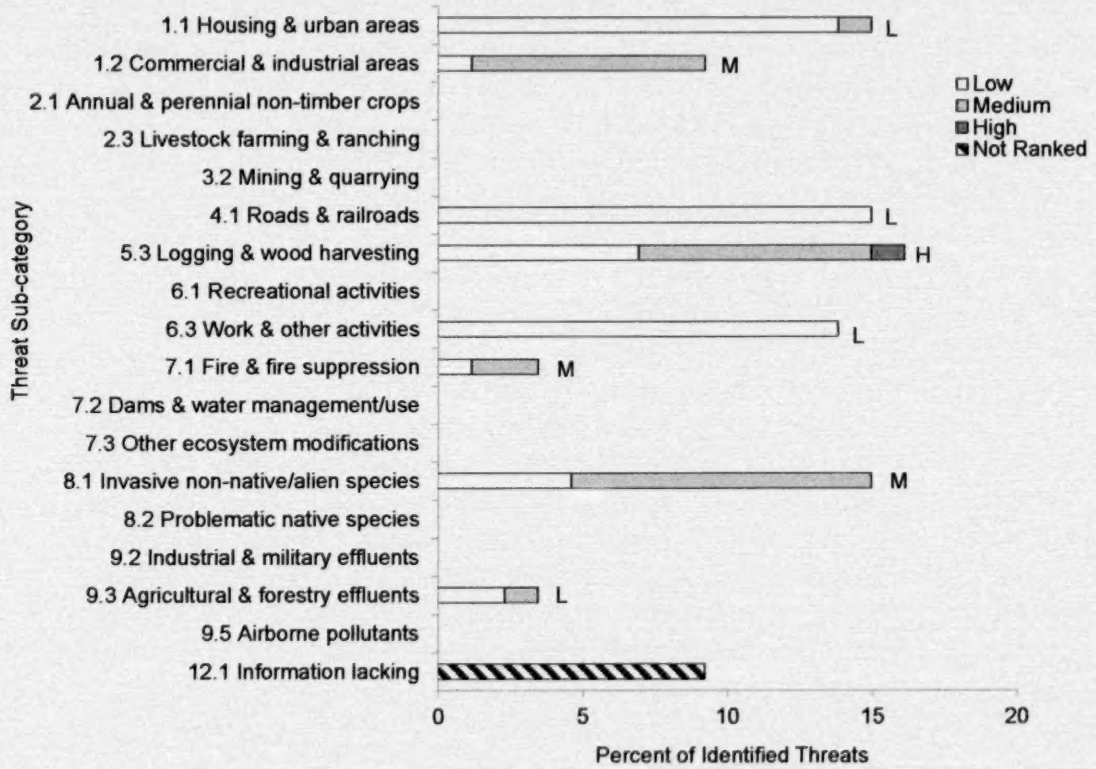

Figure 10. Percent of identified threats to priority species in coniferous habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in coniferous habitat (for example, if 100 threats were identified in total for all priority species in coniferous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category. The overall magnitude of the threat in coniferous habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 7. Threats addressed, conservation objectives, recommended actions and list of priority species affected in coniferous habitat in BCR 12 ON.
Note: Issues such as collisions with human-made structures (threats sub-category 1.2 Commercial and industrial areas), and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of habitat due to logging practices.	5.3 Logging & wood harvesting	Maintain coniferous forest habitat supply, composition, pattern, and structure within the expected range of natural variation under natural disturbance regime.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Promote the development and use of forest management guides (i.e. Silviculture, Landscape, Stand and Site Guides) that protect coniferous forest birds and other biodiversity in forest management planning on Crown land and private land (Ontario Partners in Flight 2008). Promote forest management practices that retain cavity trees and live trees in burns, wetlands and other forest openings.	4.3 Awareness and communications	Bay-breasted Warbler, Blackburnian Warbler, Black-throated Green Warbler, Canada Warbler,[2] Great Gray Owl, Northern Goshawk, Red Crossbill, Ruby-crowned Kinglet
				Support current and encourage future consideration of the needs of priority coniferous forest birds within forest management planning activities on Crown and private land (Ontario Partners in Flight 2008). Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013b).	5.2 Policies and regulations	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published, however interim conservation objectives and recommended actions are presented here.

Table 7 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				Work collaboratively with forest management planning initiatives to ensure that the use of the Ontario Ministry of Natural Resources forest management guides adequately addresses the needs of coniferous forest birds (Ontario Partners in Flight 2008). Work with partners in the United States and Latin America to conserve priority species during migration and on their wintering grounds (Ontario Partners in Flight 2008).	7.2 Alliance and partnership development	
				Encourage an adaptive management approach to the conservation of priority species, with ongoing monitoring and research to evaluate the effectiveness of forest management guidelines and outcomes (Ontario Partners in Flight 2008). Maintain or improve forest habitat mapping across BCR 12 ON, including regularly updating the Forest Resource Inventory data across the region and collecting data describing stand- and site-level features (Ontario Partners in Flight 2008).	8.2 Monitoring	
				Maintain a minimum of 500 ha (patch size) of mature to old white pine forest (foraging specialist that relies on conifer seeds year round) (Ontario Partners in Flight 2008).	1.1 Site/area protection	Red Crossbill
				Maintain supply of old-growth stands adjacent to open foraging areas.	2.1 Site/area management	Great Gray Owl, Northern Goshawk
				Determine the effect of forestry practices on nesting and prey habitats (Ontario Partners in Flight 2008).	8.1 Research	Northern Goshawk
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler

Table 7 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Fire suppression reduces the amount and limits the distribution of burned forest habitat.	7.1 Fire and fire suppression	Maintain/restore adequate amounts of post-fire forest habitat.	1.3 Ensure the continuation of natural processes that maintain bird habitat	Promote awareness of the ecological benefits and correct misconceptions regarding the role of fire in natural landscapes. Within managed landscapes, develop prescribed fire protocols to promote and retain high-value burned forest within the natural fire-return interval, distributed both spatially and temporally. Avoid burns during nesting and brood-rearing periods.	4.3 Awareness and communication 5.2 Policies and regulations	Common Nighthawk,[2] Olive-sided Flycatcher[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk, Olive-sided Flycatcher
Outbreaks of invasive non-native forest insects and tree diseases are an ongoing concern for forest habitats (e.g., Pine shoot beetle, European wood wasp).	8.1 Invasive non-native/alien species	Prevent and control the spread of invasive non-native species.	3.5 Prevent and control the spread of invasive and exotic species	Undertake an awareness campaign to deter unauthorized or accidental releases of non-native species.	4.3 Awareness and communications	Blackburnian Warbler, Canada Warbler,[2] Great Gray Owl, Nashville Warbler, Northern Goshawk, Purple Finch, Red Crossbill, Ruby-crowned Kinglet, White-throated Sparrow
				Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive, non-native species and diseases.	5.2 Policies and regulations	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler

Table 7 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Control of Spruce budworm outbreaks greatly reduces an important food resources.	9.3 Agricultural and forestry effluents	Improve understanding of avian predator-insect prey relationships.	7.4 Improve understanding of causes of population declines	Continue researching factors that promote the initiation of insect pest (e.g., Spruce budworm) outbreaks and the functional and numerical responses of avian predators to changes in insect abundance.	8.1 Research	Canada Warbler[2]
				Support monitoring of both insect outbreaks and bird species at suitable spatial and temporal scales to improve knowledge of predator-prey population dynamics.	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Lack of knowledge – breeding success, survival rates.	12.1 Information lacking	Improve knowledge of breeding ecology to inform conservation and management.	7.1 Improve population/ demographic monitoring	Study population demographics in years and/or areas with no Spruce budworm outbreaks (Bay-breasted Warbler). Increase understanding of population demography and breeding ecology; determine effects of forest management practices on abundance and distribution (Connecticut Warbler).	8.1 Research	Bay-breasted Warbler, Connecticut Warbler
Lack of knowledge (trend, population size, and/or distribution range).		Improve monitoring efforts to increase reliability of population status/trend.		Enhance monitoring efforts to increase the reliability of population status and trend assessments.	8.2 Monitoring	Common Nighthawk,[2] Olive-sided Flycatcher,[2] Red Crossbill
Lack of information on factors		Determine cause(s) of population declines.	7.4 Improve understanding of causes of	Investigate the effect of forest management treatments on breeding density, productivity and survival (Ontario Partners in Flight 2008).	8.1 Research	Canada Warbler[2]

Table 7 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
causing population declines.			population declines	Investigate potential causes of population decline including studying population demographics across a range of nesting sites and management regimes.		Olive-sided Flycatcher[2]
				Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.		Common Nighthawk[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Common Nighthawk, Olive-sided Flycatcher

Deciduous

Forest dominated by deciduous species accounts for approximately 16% of the provincial land cover of BCR 12 ON (Fig. 11; Table 1). Deciduous forest is the predominant forest class in southern portions of the region, where tolerant hardwood forests of maple, oak and yellow birch (*Betula alleghaniensis*) are common. Poplar-dominated deciduous forests are common in the northwest of the region, and white birch-dominated forests are common in the northeast (Ontario Partners in Flight 2008). Fifteen priority species use this habitat (all landbirds), including four species at risk: Canada Warbler, Cerulean Warbler, Louisiana Waterthrush and Red-headed Woodpecker (Table 8).

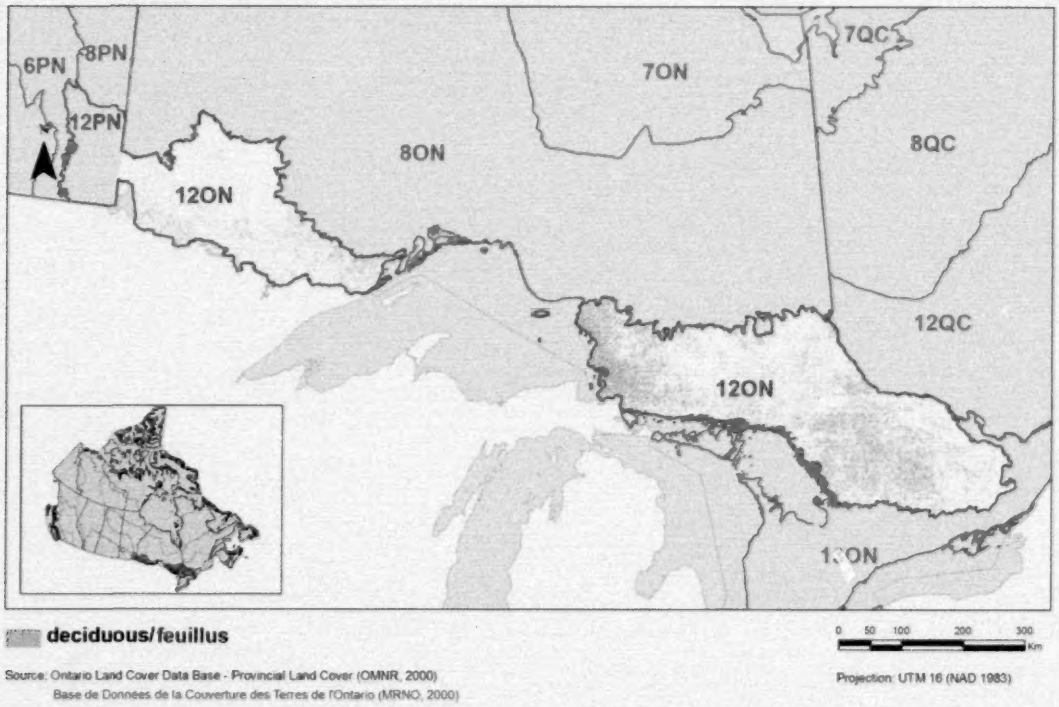

Figure 11. Map of deciduous forests in BCR 12 ON.

Table 8. Priority species that use deciduous habitat in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Black-billed Cuckoo	Early successional deciduous forests with openings	Increase					Y		
Black-throated Blue Warbler	Mature deciduous forests with dense understorey	Maintain current					Y		
Broad-winged Hawk	Deciduous and mixed forests	Maintain current					Y		
Canada Warbler	Relatively open deciduous stands	Recovery objective†	Y	Y	Y	Y	Y	Y	
Cerulean Warbler	Mature deciduous forests with sparse understorey	Recovery Objective	Y	Y	Y	Y		Y	
Eastern Wood-Pewee	Deciduous forests of any age with openings	Increase	Y			Y			
Least Flycatcher	Deciduous forests with openings	Increase					Y		
Louisiana Waterthrush	Mature forests with coldwater streams	Recovery objective	Y	Y	Y	Y		Y	Y
Northern Goshawk	Mature deciduous forests with high canopy closure, and generally low ground and shrub cover	Assess/ Maintain				Y			
Red-headed Woodpecker	Deciduous forests with openings	Recovery objective†	Y	Y	Y	Y		Y	
Rose-breasted Grosbeak	Deciduous forests with relatively open canopy	Increase					Y		
Tennessee	Early successional deciduous forests	Increase				Y			Y

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Canada Warbler: Increase; Red-headed Woodpecker: Increase.

Table 8 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Warbler									
Veery	Damp deciduous early succession forests with dense understorey	Increase				Y	Y		
Wood Thrush	Mature deciduous forests with well developed understorey	Maintain current	Y			Y		Y	
Yellow-bellied Sapsucker	Early successional deciduous forests	Maintain current					Y		Y

The vast majority of deciduous forests outside protected areas are "working forests," logged regularly (Ontario Partners in Flight 2008). Shelterwood cuts and single-tree selection are the most common harvesting methods in the tolerant hardwood stands in this region; clear-cutting of deciduous and mixed deciduous stands is much less common (Ontario Partners in Flight 2008). In some portions of the region, current and past land-use management (especially fire-suppression and abandonment of marginal farmland) have favoured deciduous forest (Carleton 2000), but whether the type of forest arising from succession and fire suppression is of equal value as habitat to deciduous bird species remains unknown. Even before widespread suppression of fire, large-scale, catastrophic fire was less frequent in the forests of this region than in the boreal forests further north.

Forest management guidelines already consider the needs of birds. In deciduous habitats, key factors to consider include (from Ontario Partners in Flight 2008):

- Current forest harvesting prescriptions, especially the choice of harvest method, patch size and configuration, and rotation cycles
- Pre- and post-harvest silvicultural treatments (thinning, brush management) that affect forest structure
- Deciduous tree diseases and hardwood dieback
- Frequency and control of insect outbreaks
- The legacy of past forest management practices, which changed age-class structure and did not retain an adequate supply of important habitat
- Fire suppression, which has altered the forest composition and increased the potential for catastrophic fires
- Forest type conversion to reverse past conversion of pine and hemlock stands to deciduous and mixed forest types, which will result in a decrease in deciduous forest habitat
- Changes in overall forest cover, including increased forest cover in the southeastern areas of the BCR due to natural succession of abandoned agricultural fields and

decreased cover locally in parts of the northeastern and western areas, where forest is being converted to agricultural production on private lands with suitable soil conditions

The threat to priority birds from forestry (threat sub-category 5.3) in deciduous habitats was determined to be of a high magnitude, as was the case for species occurring in coniferous forests. The proposed actions to counteract this threat operate at a variety of spatial scales, from the landscape scale down to that of individual wildlife trees (Table 9). This multi-scale approach is consistent with the approach followed under the Ontario *Crown Forest Sustainability Act* (Government of Ontario 1994), and acknowledges that variability in stand ages, condition and other factors across a landscape scale is a natural characteristic of forest habitats.

Deciduous forest is most common in the southern extent of the BCR, where human development is also most prevalent; loss, degradation and fragmentation of deciduous habitats from urban development was determined to be a threat of high magnitude to priority species in deciduous habitats (sub-category 1.1 ; Fig. 12). In settled landscapes, key actions to conserve deciduous forest birds include the identification and protection of important areas through municipal planning as well as woodlot management and stewardship to retain important habitat features for priority species (Table 9).

Mortality from collisions with buildings, communication towers or windows (sub-category 1.2) was assessed as a medium magnitude threat for priority species in deciduous forests. Given the wide-ranging nature of this threat, conservation objectives and actions are presented in the Widespread Issues section of this strategy, rather than in Table 9 in this section.

Invasive non-native species were determined to have medium-magnitude effects on priority bird species in this habitat type (sub-category 8.1; Fig. 12). The Emerald ash borer *(Agrilus planipennis)* is an alien beetle from China and eastern Asia that has invaded Ontario and Quebec. It is common in southwestern Ontario and in the Ottawa area, and has been observed on Manitoulin Island and in Sault Ste. Marie. This highly destructive invasive non-native species was first observed in North America in 2002 and, in the absence of control measures, is expected to spread across the entire range of ash, including BCR 12 ON, killing even healthy individuals of all ash species (Ontario Ministry of Natural Resources 2010d). Similarly, butternut canker (*Ophiognomonia clavigignenti-juglandacearum*) threatens butternut trees (*Juglans cinerea*) of all ages, and tree death is widespread and increasing (butternut has been listed as Endangered in Ontario since 2007; at a national level, it was designated Endangered in 2003 by COSEWIC and listed as Endangered under SARA in 2005). Black and white ash (*Fraxinus nigra and Fraxinus americana*) occur through the southern and western portion of BCR 12 ON, while butternut occurs at the southern edge. Awareness campaigns to deter the unauthorized or accidental release of invasive non-native species (e.g., transport of firewood harbouring pests such as the Emerald ash borer), along with the strengthening of policies and regulations to stop their spread, are necessary actions to maintain the diversity of deciduous tree species available to the priority birds of BCR 12 ON.

The full list of threats to and information needs (sub-category 12.1) for priority species in deciduous habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 9.

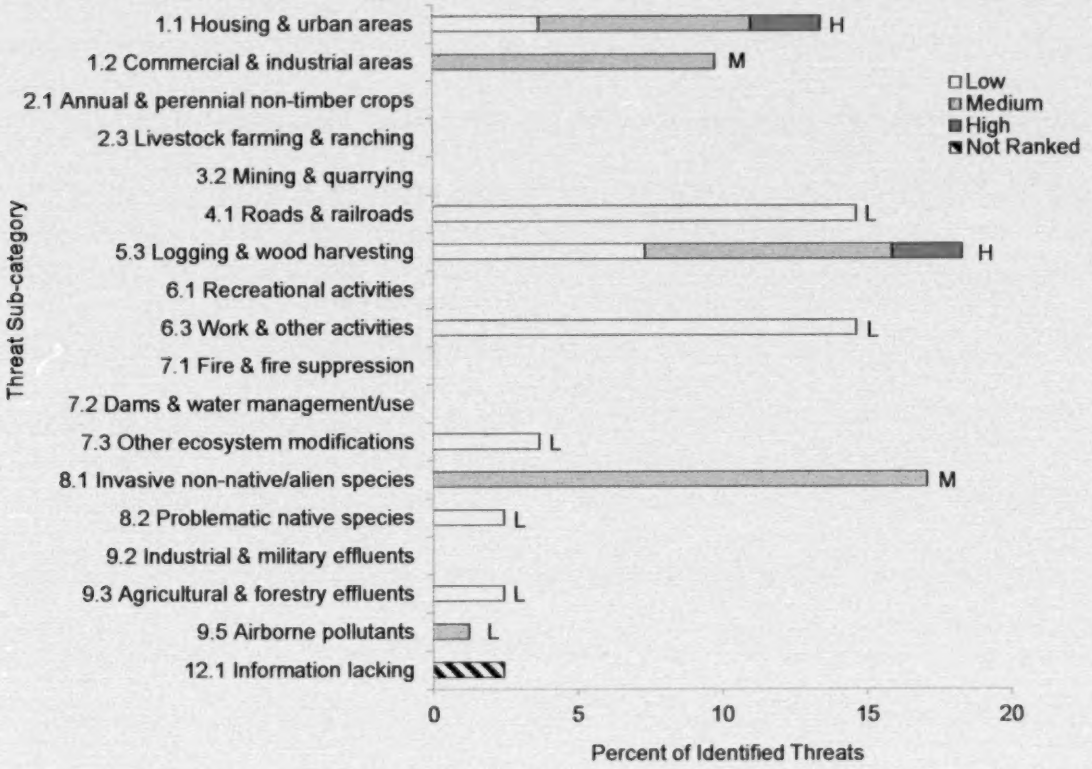

Figure 12. Percent of identified threats to priority species in deciduous habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in deciduous habitat (for example, if 100 threats were identified in total for all priority species in deciduous habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category. The overall magnitude of the threat in deciduous habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 9. Threats addressed, conservation objectives, recommended actions and list of priority species affected in deciduous habitat in BCR 12 ON.
Note: Issues such as collisions with human-made structures, vehicles (threat sub-categories 1.2 Commercial and industrial areas and 4.1 roads and railroads), and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of forest habitat due to urban development.	1.1 Housing & urban areas	Maintain, enhance or restore the quality, quantity and diversity of deciduous forest habitats in settled landscapes.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Identify and protect areas of importance to priority deciduous forest birds.	1.1 Site/area protection	Black-throated Blue Warbler, Broad-winged Hawk, Canada Warbler,[2] Northern Goshawk, Red-headed Woodpecker,[2] Veery, Wood Thrush
				Manage woodlots according to recognized silvicultural practices (e.g., *A Silvicultural Guide to Managing Southern Ontario Forests*; Ontario Ministry of Natural Resources 2000).	2.1 Site/area management	
				Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees) and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*; Ontario Ministry of Natural Resources 2011).	2.3 Habitat and natural process restoration	
				Discourage "greenfield" development in land-use planning and focus on redevelopment and development within existing urban areas. Through land-use planning, encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013b).	5.2 Policies and regulations	
				Encourage stewardship organizations to promote the use of appropriate habitat management guidelines by private landowners: e.g., *A land manger's guide to conserving habitat for forest birds in southern Ontario.* (Ontario Ministry of Natural Resources 2011).	7.2 Alliance and partnership development	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published, however interim conservation objectives and recommended actions are presented here.

Table 9 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity of forests, regional forest cover) on the abundance, distribution and demography of priority forest birds.	8.1 Research	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Cerulean Warbler, Red-headed Woodpecker
Loss and/or degradation of habitat due to logging practices.	5.3 Logging & wood harvesting	Maintain deciduous forest habitat supply, composition, pattern and structure within the expected range of natural variation under natural disturbance regime.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Promote the development and use of forest management guides (i.e. Silviculture, Landscape, Stand and Site Guides) that protect deciduous forest birds and other biodiversity in forest management planning on Crown land and private land (Ontario Partners in Flight 2008). Promote forest management practices that retain cavity trees and live trees in burns, wetlands and other forest openings.	4.3 Awareness and communications	Black-throated Blue Warbler, Broad-winged Hawk, Canada Warbler,[2] Least Flycatcher, Northern Goshawk, Red-headed Woodpecker,[2] Wood Thrush
				Support current and encourage future consideration of the needs of priority deciduous forest birds within forest management planning activities on Crown and private land (Ontario Partners in Flight 2008). Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013b).	5.2 Policies and regulations	

Table 9 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				Work collaboratively with forest management planning initiatives to ensure that the use of the Ontario Ministry of Natural Resources forest management guides adequately addresses the needs of deciduous forest birds (Ontario Partners in Flight 2008). Work with partners in the United States and Latin America to conserve priority species during migration and on their wintering grounds (Ontario Partners in Flight 2008).	7.2 Alliance and partnership development	
				Encourage an adaptive management approach to the conservation of priority species, with ongoing monitoring and research to evaluate the effectiveness of forest management guidelines and outcomes (Ontario Partners in Flight 2008). Maintain or improve forest habitat mapping across BCR 12 ON, including regularly updating the Forest Resource Inventory data across the region and collecting data describing stand- and site-level features (Ontario Partners in Flight 2008).	8.2 Monitoring	
				Maintain supply of old-growth stands adjacent to open foraging areas.	2.1 Site/area management	Broad-winged Hawk, Northern Goshawk
				Determine the effect of forestry practices on nesting and prey habitats (Ontario Partners in Flight 2008).	8.1 Research	Northern Goshawk
				Improve ability to monitor forest raptor populations in BCR 12 ON through improved breeding season surveys and/or analyses of hawk migration count data.	8.2 Monitoring	Broad-winged Hawk, Northern Goshawk
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Cerulean Warbler, Louisiana Waterthrush, Red-headed Woodpecker

Table 9 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Outbreaks of invasive non-native forest insects and tree diseases are an ongoing concern for forest habitats (e.g., Emerald ash borer).	8.1 Invasive non-native/alien species	Prevent and control the spread of invasive non-native species.	3.5 Prevent and control the spread of invasive and exotic species	Undertake an awareness campaign to deter unauthorized or accidental releases of non-native species.	4.3 Awareness and communications	Black-billed Cuckoo, Black-throated Blue Warbler, Broad-winged Hawk, Canada Warbler,[2] Eastern Wood-Pewee, Least Flycatcher, Northern Goshawk, Red-headed Woodpecker,[2] Rose-breasted Grosbeak, Tennessee Warbler, Veery, Wood Thrush, Yellow-bellied Sapsucker
				Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species and diseases.	5.2 Policies and regulations	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Cerulean Warbler, Red-headed Woodpecker
Lack of information on factors causing population declines.	12.1 Information lacking	Determine cause(s) of population decline.	7.4 Improve understanding of causes of population declines	Investigate factors causing population decline on breeding and wintering grounds.	8.1 Research	Canada Warbler,[2] Rose-breasted Grosbeak
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler

Mixed Wood

This region, the Boreal Hardwood Transition, marks the transition from coniferous, boreal forests further north to deciduous, temperate forests in the south. Accordingly, mixed wood forest is a dominant habitat type in the region, accounting for 46% of the provincial land cover (Fig. 13; Table 1). Common tree species associations include white pine and red oak, mixed hardwoods and white pine, trembling aspen (*Populus tremuloides*) and balsam fir, and eastern hemlock with sugar maple and yellow birch (Thompson 2000; Ontario Partners in Flight 2008). This habitat supports a wide diversity of bird species; 27 priority species use mixed forests including 5 species at risk (Table 10). As for other forest habitats, priority species using mixed forests are all landbirds, with the exception of the American Woodcock, a forest-dwelling shorebird.

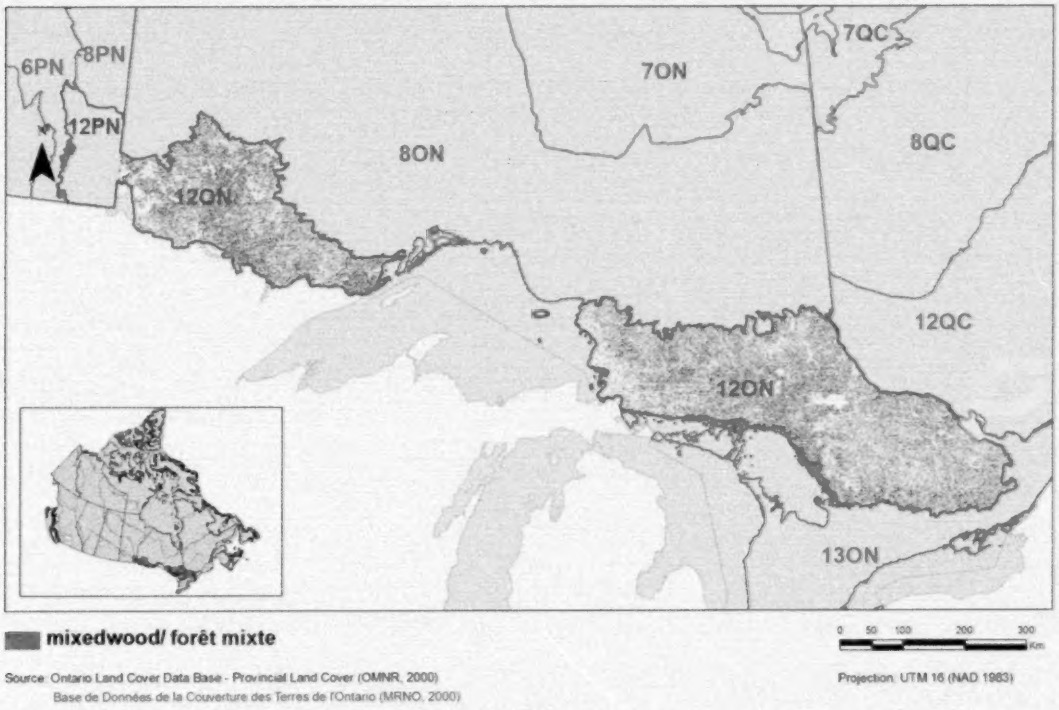

Figure 13. Map of mixed wood forests in BCR 12 ON.

Among the priority species using mixed forests are three aerial insectivores: the Common Nighthawk, the Eastern Whip-poor-will and the Olive-sided Flycatcher. These species use open habitats at dusk and dawn to forage for flying insects. Like other aerial insectivores, these species have declined significantly in abundance and distribution in recent decades. For example, Breeding Bird Survey results suggest declines of 6.4% per year for Common Nighthawk and 3.7% per year for Eastern Whip-poor-will in BCR 12 ON between 1970 and 2004 (Ontario Partners in Flight 2008). As for all aerial insectivores, the causes of these alarming

declines remain largely unknown but could be related to a reduction in the availability of their insect prey (Nebel et al. 2010).

Research and monitoring objectives and actions identified in Table 11 focus on gathering information to better understand the factor(s) associated with these population declines and to enhance the reliability of population status and trend information collected for Common Nighthawk, a species active at twilight (a crepuscular species), and Olive-sided Flycatcher (threat sub-category 12.1).

Table 10. Priority species that use mixed wood habitat in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional. Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Woodcock	Young mixed forests	Increase				Y		Y	
Blackburnian Warbler	Mature mixed forests	Maintain current					Y	Y	Y
Black-throated Blue Warbler	Mature mixed forests with dense understorey	Maintain current					Y		
Black-throated Green Warbler	Mature mixed forests with complex vertical layers	Maintain current					Y	Y	Y
Broad-winged Hawk	Mixed and deciduous forests	Maintain current					Y		
Canada Warbler	Relatively open mixed forests	Recovery objective†	Y	Y	Y	Y	Y	Y	
Common Nighthawk	Mixed deciduous forests	Recovery objective†	Y	Y	Y	Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Canada Warbler: Increase; Common Nighthawk: Assess/Maintain; Eastern Whip-poor-will: Increase; Olive-sided Flycatcher: Increase.

Table 10 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional. Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Eastern Whip-poor-will	Early-mid successional forests with openings	Recovery objective†	Y	Y	Y	Y		Y	
Eastern Wood-Pewee	Mixed forests of any age with openings	Increase	Y			Y			
Evening Grosbeak	Mature mixed forests with openings	Increase				Y			
Great Gray Owl	Mature mixed forests with openings	Assess/ Maintain				Y			
Least Flycatcher	Mixed forests with openings	Increase					Y		
Louisiana Waterthrush	Mature forests with coldwater streams	Recovery objective	Y	Y	Y	Y		Y	Y
Mourning Warbler	Regenerating mixed forests with dense understorey	Increase					Y	Y	Y
Nashville Warbler	Open second-growth mixed and coniferous forests	Maintain current					Y		Y
Northern Flicker	Mixed forests with openings	Increase				Y			
Northern Goshawk	Mature mixed forests with high canopy closure, and generally low ground and shrub cover	Assess/ Maintain				Y			
Olive-sided Flycatcher	Mixed, coniferous-dominated forests	Recovery objective†	Y	Y	Y	Y		Y	
Purple Finch	Mixed forests with openings; Spruce budworm specialist	Increase				Y			
Red-shouldered Hawk	Mixed deciduous forest	Assess/ Maintain				Y			Y
Rose-breasted Grosbeak	Mixed forests with relatively open canopy	Increase					Y		
Ruby-crowned Kinglet	Mixed forests	Increase				Y			
Ruffed Grouse	Early successional mixed forests	Maintain current					Y		
Tennessee Warbler	Early successional mixed forests with openings; Spruce budworm specialist	Increase				Y			Y
White-throated Sparrow	Mixed forests with openings and low dense vegetation	Maintain current					Y	Y	Y
Wood Thrush	Mature mixed forests with well-developed understorey	Maintain current	Y			Y		Y	
Yellow-bellied Sapsucker	Early successional mixed forests	Maintain current					Y		Y

Threats related to logging (sub-category 5.3) were considered to have a high magnitude effect overall on priority bird populations in mixed wood forests, equivalent to the magnitude in coniferous forests (Fig. 14). Some of the current mixed forests in the region resulted from unsustainable harvest of large conifers in the 18th and 19th century, especially white pine, and the subsequent conversion of the habitat to mixed hardwood communities (Thompson 2000). Fire suppression has further encouraged the growth of deciduous species within coniferous forest. As in other forest habitats in the region, forestry management guidelines already consider the needs of birds; however, conservation actions meriting additional consideration are proposed in Table 11.

Additional threats to priority species relating to habitat loss and degradation from urban development (sub-category 1.1) and mortality from collisions with buildings, communication towers or windows (sub-category 1.2) as well as invasive non-native forest pests (sub-category 8.1) occur in mixed forests as they do in other forested habitats in the region.

The full list of threats to and information needs (sub-category 12.1) for priority species in mixed wood habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 11.

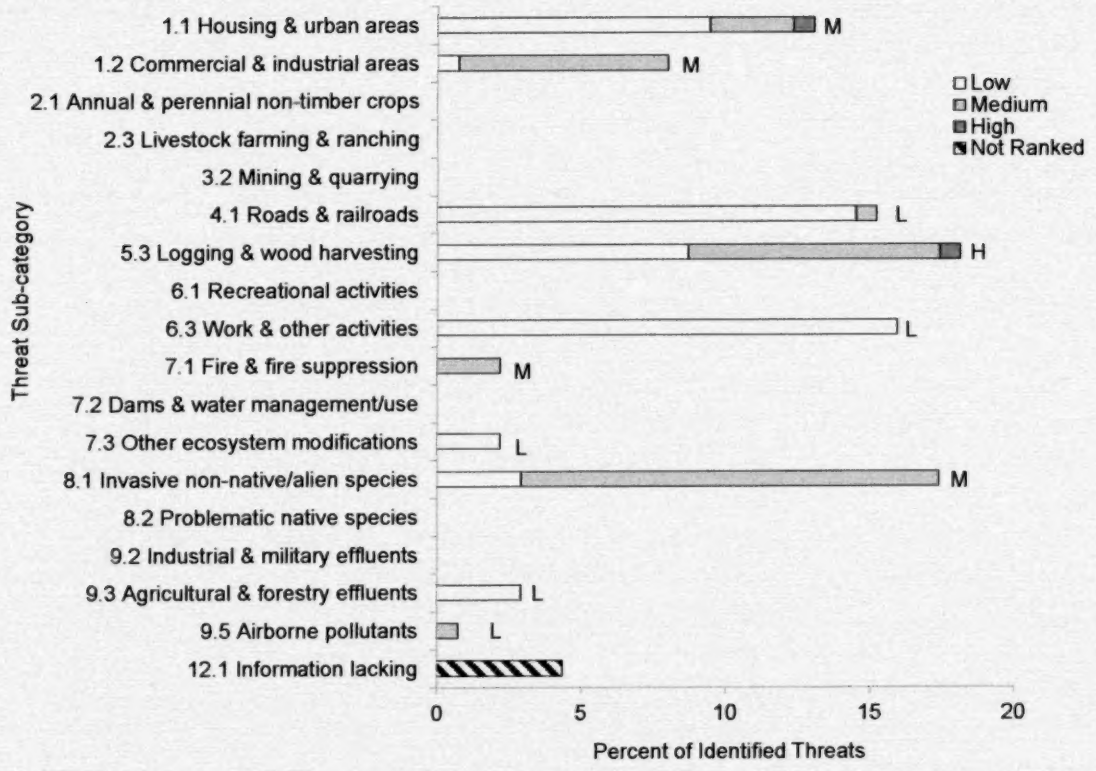

Figure 14. Percent of identified threats to priority species in mixed wood habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in mixed wood habitat (for example, if 100 threats were identified in total for all priority species in mixed wood habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M), and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M, and H rankings in the sub-category. The overall magnitude of the threat in mixed wood habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 11. Threats addressed, conservation objectives, recommended actions and list of priority species affected in mixed wood habitats in BCR 12 ON.
Note: Issues such as collisions with human-made structures, vehicles (threats sub-category 1.2 Commercial and industrial areas and 4.1 roads and railroads), and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of forest habitat due to urban development.	1.1 Housing & urban areas	Maintain, enhance or restore the quality, quantity and diversity of mixed forest habitats in settled landscapes.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Identify and protect areas of importance to priority mixed wood forest birds.	1.1 Site/area protection	Black-throated Blue Warbler, Broad-winged Hawk, Northern Goshawk, Red-shouldered Hawk, Wood Thrush
				Manage woodlots according to recognized silvicultural practices (e.g., *A Silvicultural Guide to Managing Southern Ontario Forests*; Ontario Ministry of Natural Resources 2000).	2.1 Site/area management	
				Retain important habitat features such as wildlife trees (e.g., stick nests, cavity trees) and downed woody debris (see *A land manager's guide to conserving habitat for forest birds in southern Ontario*; Ontario Ministry of Natural Resources 2011).	2.3 Habitat and natural process restoration	
				Discourage "greenfield" development in land-use planning and focus on redevelopment and development within existing urban areas. Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013b).	5.2 Policies and regulations	
				Encourage stewardship organizations to promote the use of appropriate habitat management guidelines by private landowners: e.g., *A land manger's guide to conserving habitat for forest birds in southern Ontario.* (Ontario Ministry of Natural Resources 2011).	7.2 Alliance and partnership development	
				Conduct research to increase understanding of the effects of forest condition, management practices, and landscape variables (proximity of forests, regional forest cover) on the abundance, distribution, and demography of priority forest birds.	8.1 Research	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.

Table 11 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of habitat due to logging practices.	5.3 Logging & wood harvesting	Maintain mixed forest habitat supply, composition, pattern and structure within the expected range of natural variation under natural disturbance regime.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Promote the development and use of forest management guides (i.e. Silviculture, Landscape, Stand and Site Guides) that protect mixed wood forest birds and other biodiversity in forest management planning on Crown land and private land (Ontario Partners in Flight 2008). Promote forest management practices that retain cavity trees and live trees in burns, wetlands and other forest openings.	4.3 Awareness and communications	Blackburnian Warbler, Black-throated Blue Warbler, Black-throated Green Warbler, Broad-winged Hawk, Canada Warbler,[2] Eastern Whip-poor-will,[2] Great Gray Owl, Northern Flicker, Northern Goshawk, Red-shouldered Hawk, Ruby-crowned Kinglet, Wood Thrush
				Support current and encourage future consideration of the needs of priority mixed wood forest birds within forest management planning activities on Crown and private land (Ontario Partners in Flight 2008). Encourage municipalities to protect or restore significant woodlots (e.g., mature, old-growth), including having at least one, and preferably several, 200-hectare forest patches (Environment Canada 2013b).	5.2 Policies and regulations	
				Work collaboratively with forest management planning initiatives to ensure that the use of the Ontario Ministry of Natural Resources forest management guides adequately addresses the needs of mixed forest birds (Ontario Partners in Flight 2008). Work with partners in the United States and Latin America to conserve priority species during migration and on their wintering grounds (Ontario Partners in Flight 2008).	7.2 Alliance and partnership development	
				Encourage an adaptive management approach to the conservation of priority species, with ongoing monitoring and research to evaluate the effectiveness of forest management guidelines and outcomes	8.2 Monitoring	

[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 11 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				(Ontario Partners in Flight 2008). Maintain or improve forest habitat mapping across BCR 12 ON, including regularly updating the Forest Resource Inventory data across the region and collecting data describing stand- and site-level features (Ontario Partners in Flight 2008).		
				Maintain supply of old-growth stands adjacent to open foraging areas.	2.1 Site/area management	Broad-winged Hawk, Great Gray Owl, Northern Goshawk
				Determine the effect of forestry practices on nesting and prey habitats (Ontario Partners in Flight 2008).	8.1 Research	Northern Goshawk
				Improve ability to monitor forest raptor populations in Ontario's BCR 12 through improved breeding season surveys and/or analyses of hawk migration count data (Ontario Partners in Flight 2008).	8.2 Monitoring	Broad-winged Hawk, Northern Goshawk
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Eastern Whip-poor-will, Louisiana Waterthrush
Habitat loss due to fire suppression (changes in habitat structure/ composition/ age class).	7.1 Fire & fire suppression	Maintain/ restore adequate amounts of post-fire forest habitat.	1.3 Ensure the continuation of natural processes that maintain bird habitat	Promote awareness of the ecological benefits, and correct misconceptions regarding the role, of fire in natural landscapes.	4.3 Awareness and communications	Olive-sided Flycatcher,[2] Ruffed Grouse, Common Nighthawk[2]
				Develop "free-to-burn" or prescribed fire protocols to promote and retain high-value burned forest within the natural fire-return interval, distributed both spatially and temporally, throughout the region. Avoid burns during nesting and brood-rearing periods.	5.2 Policies and regulations	
		Meet the legal requirements for a federal/provinci	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk, Olive-sided Flycatcher

Table 11 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		al Species at Risk legislation.				
Outbreaks of invasive non-native forest insects and tree diseases are an ongoing concern for forest habitats (e.g., Emerald ash borer, Pine shoot beetle).	8.1 Invasive non-native/alien species	Prevent and control the spread of invasive non-native species.	3.5 Prevent and control the spread of invasive and exotic species	Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species and diseases.	5.2 Policies and regulations	American Woodcock, Black-throated Blue Warbler, Broad-winged Hawk, Canada Warbler,[2] Eastern Whip-poor-will,[2] Eastern Wood-Pewee, Evening Grosbeak, Great Gray Owl, Least Flycatcher, Mourning Warbler, Nashville Warbler, Northern Flicker, Northern Goshawk, Purple Finch, Red-shouldered Hawk, Rose-breasted Grosbeak, Ruffed Grouse, White-throated Sparrow, Wood Thrush, Yellow-bellied Sapsucker
				Undertake an awareness campaign to deter unauthorized or accidental releases of invasive non-native species.	4.3 Awareness and communications	
		Meet the legal requirements for a federal/provincial Species at Risk legislation	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Canada Warbler, Eastern Whip-poor-will
Lack of information on factors causing population declines.	12.1 Information lacking	Determine cause(s) of population decline.	7.4 Improve understanding of causes of population declines	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores. (Common Nighthawk; Eastern Whip-poor-will). Investigate potential causes of population declines	8.1 Research	Canada Warbler,[2] Common Nighthawk,[2] Eastern Whip-poor-will,[2] Olive-sided Flycatcher[2]

Table 11 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				including studying population demographics across a range of nesting sites and management regimes (Olive-sided Flycatcher). Investigate the effect of forest management treatments on breeding density, productivity and survival (Canada Warbler). Investigate factors causing population decline including effects of land use and food supply on breeding density, productivity and survival (Eastern Whip-poor-will).		
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Lack of knowledge (trend, population size, and/or distribution range).		Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/ demographic monitoring	Enhance monitoring efforts to increase the reliability of population status and trend assessments.	8.2 Monitoring	Common Nighthawk,[2] Olive-sided Flycatcher[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	

Shrub and Early Successional

Shrub and early successional habitat as defined by provincial land cover (Table 1; recently cut, recently burned or regenerating forest) is a rare habitat type in BCR 12 ON, accounting for less than 3% of the land cover (Fig. 15). Information on the current extent of this habitat type is less complete than for other habitat types because it is difficult to differentiate from other classes in satellite imagery, is quickly outdated and is therefore likely under-represented (Ontario Partners in Flight 2008).

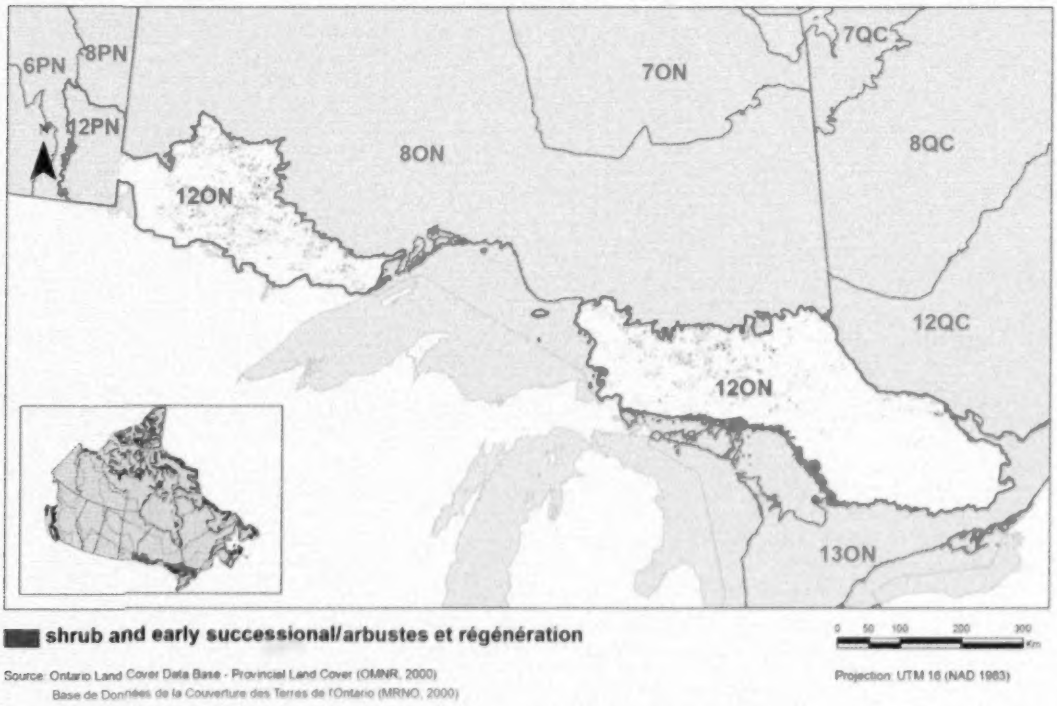

Figure 15. Map of shrub and early successional habitat in BCR 12 ON.

Nineteen priority species use shrub and early successional habitats extensively in BCR 12 ON (Table 12). All are landbirds, except the American Woodcock, a shorebird. Included on this list are five species at risk: the Common Nighthawk, the Golden-winged Warbler, the Kirtland's Warbler, the Loggerhead Shrike (*migrans* subspecies) and the Olive-sided Flycatcher.

Table 12. Priority species that use shrub and early successional habitats in BCR 12 ON, a more detailed habitat description, population objectives, and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Woodcock	Shrubby old fields and forest openings	Increase				Y		Y	
Black-billed Cuckoo	Shrubby old fields and thickets; forest edges and openings	Increase					Y		
Brown Thrasher	Shrubby overgrown pastures; alvars, shrubby thickets, hedgerows	Increase				Y			Y
Chestnut-sided Warbler	Shrubby second-growth deciduous forest edges, abandoned fields, small clearings, regenerating forests	Maintain current					Y	Y	Y
Common Nighthawk	Regenerating forests, shrubby forest edges, cutovers and burns	Recovery objective†	Y	Y	Y	Y		Y	
Eastern Towhee	Shrubby old fields, Precambrian rock barrens, sand barrens and alvars	Increase				Y		Y	Y
Field Sparrow	Shrubby old fields, roadsides, alvars and rock barrens	Assess/ Maintain				Y			
Golden-winged Warbler	Shrubby old fields, forest edges and openings	Recovery objective†	Y	Y	Y	Y	Y	Y	
Gray Catbird	Thickets and tangled shrubbery in forest clearings, forest edges, abandoned fields and hedgerows	Increase				Y			
Kirtland's Warbler	Extensive tracts of early successional, densely-stocked Jack pine	Recovery objective	Y	Y	Y	Y	Y	Y	
Loggerhead Shrike (*migrans*)	Early-successional shrubby fields	Recovery objective	Y	Y	Y	Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Canada Warbler: Increase; Common Nighthawk: Assess/Maintain; Golden-winged Warbler: Maintain Current; Olive-sided Flycatcher: Increase.

Table 12 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Mourning Warbler	Regenerating forests, burns, hydro rights-of-way and roadsides	Increase					Y	Y	Y
Nashville Warbler	Regenerating forests, shrubby forest edges; shrubby old fields	Maintain current					Y		Y
Olive-sided Flycatcher	Regenerating forests, shrubby forest edges; cutovers and burns	Recovery objective[†]	Y	Y	Y	Y		Y	
Prairie Warbler	Open oak-pine-juniper communities on rock barrens	Assess/ Maintain				Y		Y	
Song Sparrow	Open, shrubby riparian areas	Increase				Y			
Tennessee Warbler	Regenerating forests; shrubby forest edges; Spruce budworm specialist	Increase				Y			Y
Veery	Damp second-growth forests with dense shrubbery and ground cover	Increase				Y	Y		
White-throated Sparrow	Regenerating forests and shrubby forest edges	Maintain current					Y	Y	Y

Shrub and early successional habitats are generally transient, occurring where disturbance has removed the tree cover and the vegetation is dominated by shrubby, early seral[9] forms. Habitat availability is an important factor for all priority species in this habitat type given its inherently short-lived or dynamic nature. Activities that alter the natural disturbance regime therefore affect the amount and quality of these habitats available to priority birds in the region. Most forest fires are effectively suppressed throughout BCR 12 ON, reducing the amount of post-fire habitat available to birds and, as such, fire suppression (threat sub-category 7.1) was assessed as the highest threat to priority species (Fig. 16). However, forestry activities create disturbances at a variety of spatial scales, from canopy gaps in selection cutting prescriptions, to clear-cutting of entire blocks in the northern portion of the region. Regulators are increasingly attempting to implement forestry practices that mimic natural patterns of disturbance at a landscape scale; once fully realized, the availability of early successional habitats should reflect historical conditions (Ontario Ministry of Natural Resources 2001; Table 13). Although threats from forestry practices were not determined to be a threat to priority species in early successional habitats, inadequate knowledge of historical conditions and a lack of clarity about the quality of post-harvest habitats (versus those following natural disturbances) mean that some uncertainty remains about how priority bird populations will respond to forest management actions (Ontario Partners in Flight 2008).

[9] An intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Mortality from collisions with buildings, communication towers or windows (sub-category 1.2) was assessed as a medium magnitude threat for priority species in early successional habitats. Given the wide-ranging nature of this threat, conservation objectives and actions are presented in the Widespread Issues section of this strategy, rather than in Table 13 in this section.

Problematic native species (sub-category 8.2) were assessed as a medium-level threat to the Golden-winged Warbler, a federally and provincially listed species at risk (Fig. 16). According to national Breeding Bird Survey data, this species has declined by 79% over the last 10 years. The main threat appears to be competition and genetic swamping (hybridization) from the closely related Blue-winged Warbler, which is spreading north because of habitat change and perhaps climate change (COSEWIC 2006). Conservation actions for Golden-winged Warbler include research to assess the effects of habitat management techniques on the abundance, productivity, recruitment and site fidelity of both of these warblers as well as to study habitat partitioning and hybridization between the two species (Table 13).

The full list of threats to and information needs (sub-category 12.1) for priority species in shrub and early successional habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 13.

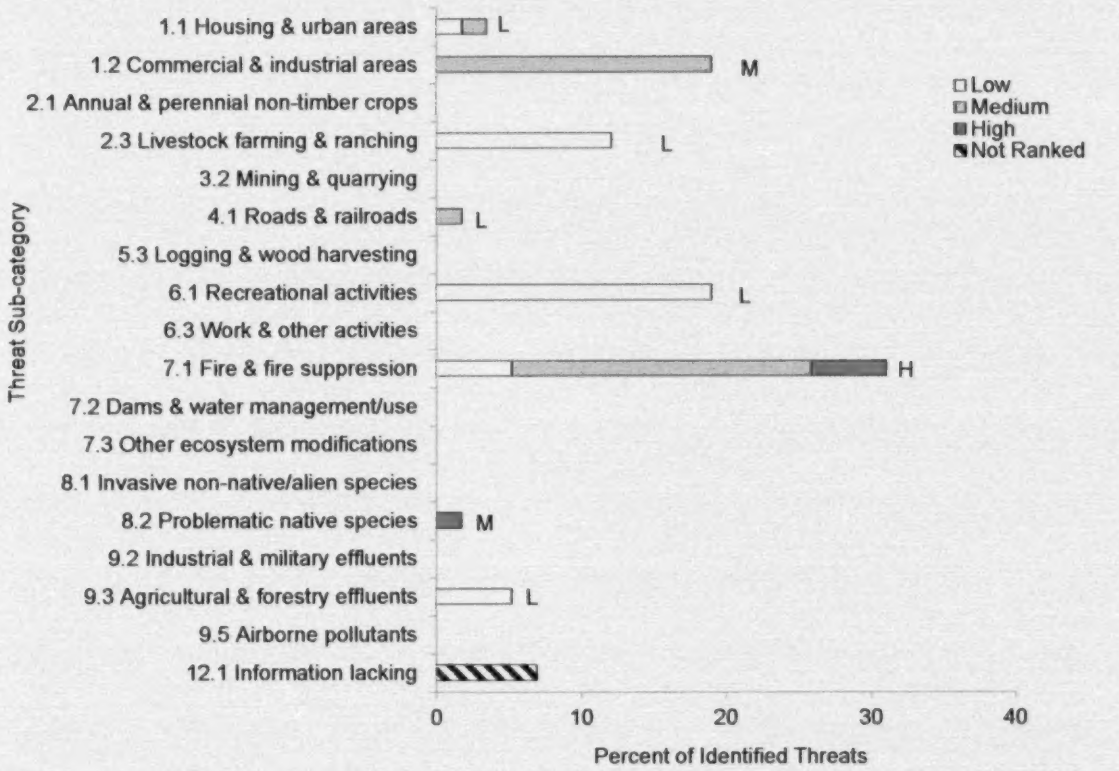

Figure 16. Percent of identified threats to priority species in shrub and early successional habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in shrub and early successional habitat (for example, if 100 threats were identified in total for all priority species in shrub and early successional habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category. The overall magnitude of the threat in shrub and early successional habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 13. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in shrub and early successional habitats in BCR 12 ON.

Note: Issues such as collisions with human-made structures and vehicles (threats sub-category 1.2 Commercial and industrial areas and 4.1 roads and railroads) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Fire suppression practices may limit the amount of successional habitat created by natural disturbance processes.	7.1 Fire & fire suppression	Maintain shrub/early successional habitat composition, pattern and structure within the estimated natural range of variation.	1.2 Maintain the size, shape and configuration of habitat within the natural range of variation	Emulate natural disturbances where appropriate, to maintain a range of successional states (e.g., controlled burns). Avoid burns during nesting and brood-rearing periods.	2.3 Habitat and natural process restoration	American Woodcock, Brown Thrasher, Chestnut-sided Warbler, Common Nighthawk,[2] Field Sparrow, Golden-winged Warbler,[2] Mourning Warbler, Nashville Warbler, Olive-sided Flycatcher,[2] Prairie Warbler, Song Sparrow, Tennessee Warbler, White-throated Sparrow
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk, Golden-winged Warbler, Kirtland's Warbler, Loggerhead Shrike (*migrans*), Olive-sided Flycatcher
Golden-winged Warbler populations experience high levels of Blue-winged Warbler hybridization.	8.2 Problematic native species	Improve understanding of basic ecology and potential limiting factors.	7.4 Improve understanding of causes of population declines	Assess the effects of habitat management techniques on the abundance, productivity, recruitment and site fidelity of Blue-winged and Golden-winged Warblers. Study habitat partitioning and hybridization between Blue-winged and Golden-winged Warblers in Ontario.	8.1 Research	Golden-winged Warbler[2]

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.

[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 13 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Lack of information on factors causing population declines.	12.1 Information lacking	Determine cause(s) of population decline	7.4 Improve understanding of causes of population declines	Conduct research to better understand the reasons for population declines of the aerial insectivore guild. Investigate potential causes of population declines including studying population demographics across a range of nesting sites and management regimes (Olive-sided Flycatcher).	8.1 Research	Common Nighthawk,[2] Olive-sided Flycatcher[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Lack of knowledge (trend, population size, and/or distribution range).		Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend for Common Nighthawk (crepuscular species not well sampled by the Breeding Bird Survey); and Olive-sided Flycatcher.	8.2 Monitoring	Common Nighthawk,[2] Olive-sided Flycatcher[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	

Cultivated and Managed Areas

Cultivated and managed areas, including pasture (open grassland with sparse shrubs), cropland (row crops and fallow fields), hedgerows and other undifferentiated, managed habitats in rural areas are a rare habitat type in BCR 12 ON, accounting for only 2% of the provincial land cover (Fig. 17; Table 1). Agricultural landscapes are found along the southern boundary of the BCR in township-sized areas around major centres, the clay belt west of New Liskeard, and between Rainy Lake and Lake of the Woods (Pearce 2011). This is in stark contrast to BCR 13 to the south, where agricultural lands cover some 60% of the landscape.

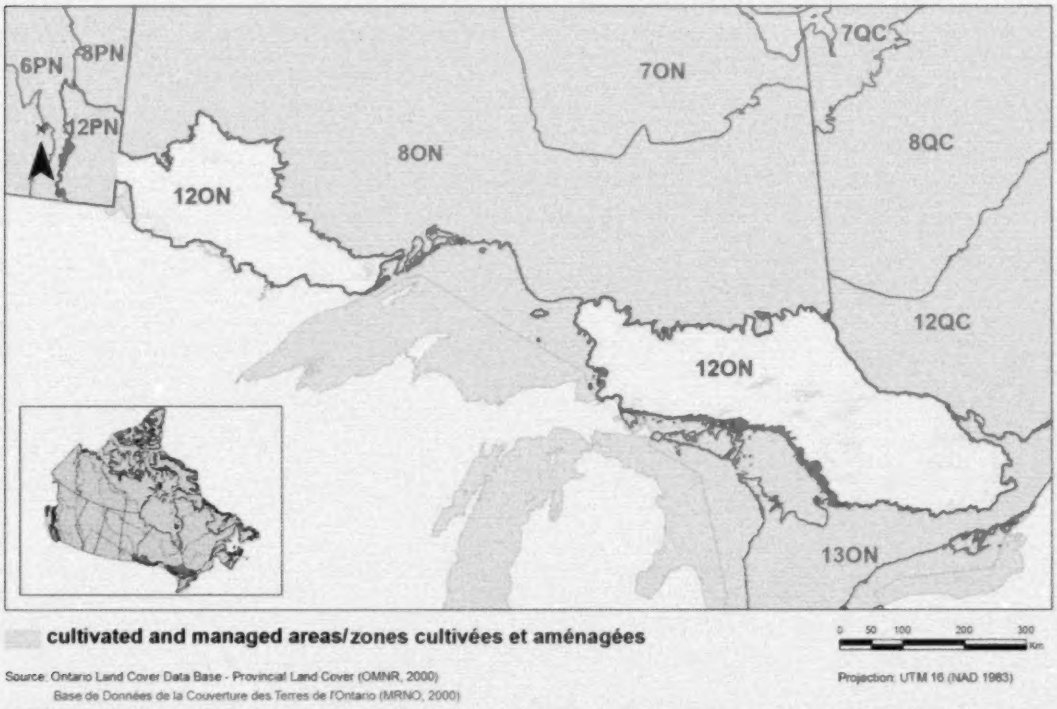

Figure 17. Map of cultivated and managed habitat in BCR 12 ON.

The priority species using this habitat class are varied, including 11 landbirds, 5 waterfowl and 1 shorebird (Table 14). Among these are a number of aerial insectivores, species of high conservation concern owing to pronounced recent declines in abundance. Insectivorous birds in agricultural areas can encounter harmful levels of pesticides (threat sub-category 9.3; e.g., Mora et al. 2006), and this exposure is recognised as a threat of high magnitude to a number of priority species including aerial insectivores (Fig. 18; Table 15). The suggested conservation actions focus primarily on the adoption of BMPs such as Integrated Pest Management[10] (IPM), and other activities that allow priority birds to coexist with agriculture.

[10] Integrated Pest Management focuses on identifying and monitoring pests, choosing a threshold of acceptable pest damage, and selecting from a variety of targeted control practices.

Table 14. Priority species that use cultivated and managed habitats in BCR 12 ON, habitat description, population objectives, and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Black Duck	Agricultural fields; cropland	Increase				Y		Y	
American Kestrel	Agricultural fields, forest edges; short to medium height groundcover	Increase				Y			
Bank Swallow	Graminoid crops; old field, hay field, fallow field	Increase	Y			Y			
Barn Swallow	Old field, hay field, pasture, fallow field	Recovery objective	Y		Y	Y			
Bobolink	Large open agricultural grasslands, older hayfields, meadows, fallow fields	Recovery objective	Y		Y	Y		Y	
Canada Goose (Southern James Bay population)	Agricultural fields; cropland	Migrant (no BCR 12 ON population objective)				Y		Y	
Canada Goose (Eastern Temperate-breeding population)	Agricultural fields; short graminoid crops, managed landscapes, parks, lawns, golf courses	Decrease				Y			
Common Nighthawk	Agricultural fields; graminoid crops; pastures	Recovery objective[†]	Y	Y	Y	Y		Y	
Green-winged Teal	Agricultural fields; cropland	Maintain current				Y			
Killdeer	Short graminoid crops; heavily grazed fields, cultivated fields, airports, golf courses	Increase				Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[†] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Common Nighthawk: Assess/Maintain; Short-eared Owl: Assess/Maintain.

Table 14 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Loggerhead Shrike *migrans*	Heavily grazed pastures with scattered low trees and shrubs	Recovery objective	Y	Y	Y	Y		Y	
Mallard	Agricultural fields; cropland	Maintain current				Y		Y	
Northern Rough-winged Swallow	Agricultural fields; cropland	Increase				Y			
Purple Martin	Agricultural fields; graminoid crops	Increase				Y			
Short-eared Owl	Agricultural fields; cultivated fields, hayfields	Recovery objective†	Y	Y	Y	Y		Y	
Tree Swallow	Agricultural fields; graminoid crops	Increase				Y			
Vesper Sparrow	Short graminoid crops; heavily grazed pastures	Increase				Y			

Aerial insectivores use cultivated and managed habitat primarily for foraging, but other priority landbirds nest in the vegetation of managed grasslands and croplands, including the Bobolink. This species, listed provincially as Threatened, breeds in hayfields and has suffered as a result of the succession of marginal farmland to shrub and forest habitats, as well as a trend towards more intensive agriculture on remaining lands. Agricultural practices, such as mowing of hay during the breeding season, may inadvertently kill and disturb nesting adults and young birds and destroy eggs and nests (sub-category 6.3). Cutting hay often coincides with the time that young birds are in the nest and are not able to fly. In addition, the quality of nesting habitat has likely declined over time due the availability of earlier maturing seed mixtures and shorter crop rotation cycles. A variety of changes in land management and the implementation of BMPs could benefit this and other priority species (Table 15).

Several waterfowl species use cultivated or managed habitats for breeding or foraging during migration, including the Green-winged Teal and the two priority populations of Canada Goose. The Southern James Bay population of Canada Geese migrate through this BCR, stopping briefly in agricultural fields to forage before continuing on to their wintering grounds. The Eastern Temperate-breeding population of Canada Geese, unlike most populations of geese that nest in arctic or sub-arctic areas, nest in temperate climates associated with more southerly latitudes. Temperate-breeding Canada Geese have benefited greatly from adapting to the human-modified landscape present today, primarily because there is an abundance of food in the form of agricultural crops and manicured lawns (cottage and residential lawns, parks, golf courses, etc). Since the early 1970s, the population in southern Ontario has increased from about 2 000 breeding pairs to an average of about 80 000 since 2005 (Environment Canada, in prep.). They

use food and other resources present in urban and agricultural landscapes for nesting, raising young, molting, feeding, and resting. This has led to increasing conflict between geese and people (e.g., depredation and damage to agricultural crops), particularly in Ontario's BCR 13. Given the very high abundance of this species in southern Ontario, it is a species of management interest with respect to preventing and reducing human-goose conflicts (see Management of Nuisance Species in Table 15).

Threats to priority species related to agricultural practices were identified as medium-magnitude threats in this habitat (sub-category 2.1). Due to the wide diversity of species using this habitat type, no one management prescription can eliminate all threats and benefit all species. For example, birds of prey benefit from shorter grass and the presence of woody vegetation for perching and hunting, while nesting waterfowl require dense vegetative cover. Accordingly, the suggested actions include management at a large spatial scale to ensure a suitable mosaic of habitats, as well as at the site level to retain important habitat features such as large cavity trees for nesting (Table 15).

The full list of threats to and information needs (sub-category 12.1) for priority species in cultivated and managed habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 15.

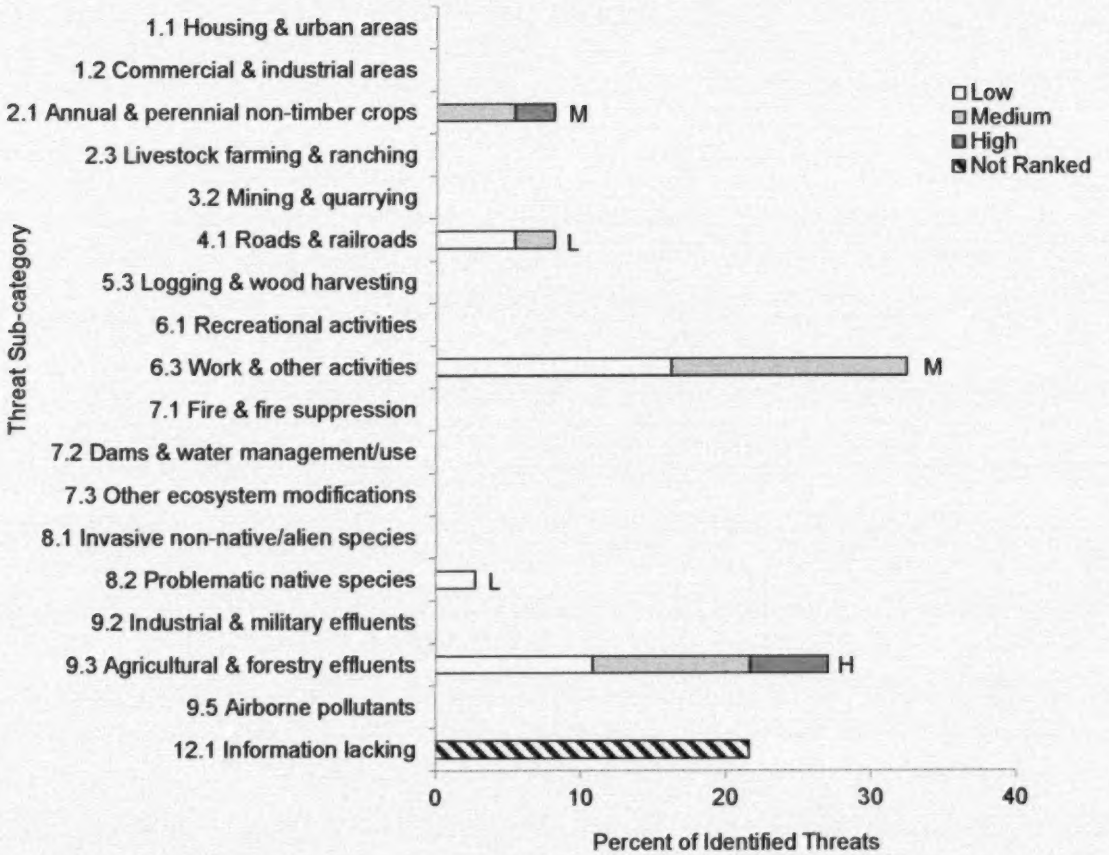

Figure 18. Percent of identified threats to priority species in cultivated and managed habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in cultivated and managed habitat (for example, if 100 threats were identified in total for all priority species in cultivated and managed habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category. The overall magnitude of the threat in cultivated and managed habitat is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 15. Threats addressed, conservation objectives, recommended actions, and list of priority species affected in cultivated and managed areas in BCR 12 ON.

Note: Issues such as collisions with vehicles (threats sub-category 4.1 Roads and Railroads) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Clearing woody vegetation eliminates roosting, perching, hunting and nesting sites. May be limiting in some areas of the BCR.	2.1 Annual & perennial non-timber crops	Maintain, enhance or restore the quality, quantity and diversity of managed grassland habitats in BCR 12 ON.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Manage agricultural landscape composition, pattern and structure to be representative of the full range of open country habitat types, successional stages and stand structures possible. (Pearce 2011). Maintain existing hedgerow and shelterbelt habitats on farms and manage them to enhance structural complexity and native plant species diversity (Pearce 2011).	2.1 Site/area management	American Kestrel, Tree Swallow
				Develop and implement a suite of regionally-appropriate BMPs (e.g., guidelines for the amount, type, size and configuration, distribution, and management of grassland habitats) to benefit priority species in this BCR.	5.3 Private sector standards and codes	
		Maintain important bird habitat features on the landscape.	1.4 Maintain important bird features on the landscape	Retain large cavity trees and mature trees in open grassland/agricultural settings for nesting cavities and hunting perches. Install nest boxes in areas of suitable habitat where natural cavities are lacking.	2.1 Site/area management	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Loggerhead Shrike *(migrans)*

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because either 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.

Table 15 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Disturbance of nesting birds can reduce productivity.	6.3 Work & other activities	Reduce/eliminate human disturbance from work or other activities.	4.1 Reduce disturbance from human activities	Raise awareness about the effect of human disturbance on priority bird species.	4.3 Awareness and communications	American Black Duck, Killdeer, Short-eared Owl,[2] Vesper Sparrow
				Develop and/or implement BMPs for agricultural grasslands as appropriate for the protection of priority grassland birds (e.g., *Birds on the Farm: A Stewardship Guide*; McGauley 2004).	5.3 Private sector standards and codes	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Barn Swallow, Bobolink, Short-eared Owl
Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration caused by exposure to or use of pesticides.	9.3 Agricultural & forestry effluents	Reduce use of pesticides.	2.1 Reduce mortality and/or sub-lethal effects from pesticide use	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	4.3 Awareness and communications	American Kestrel, Bank Swallow, Northern Rough-winged Swallow, Purple Martin
				Improve regulation of agricultural pesticides in Canada to reduce bird mortality and sub-lethal effects.	5.2 Policies and regulations	
				Promote the use of IPM programs to reduce pesticide use.	5.3 Private sector standards and codes	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Barn Swallow, Loggerhead Shrike (*migrans*),
Lack of information	12.1 Information	Determine sources of mortality or	7.4 Improve understanding	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	8.1 Research	Bank Swallow, Common

[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 15 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
on factors causing population declines.	lacking	population decline(s).	of causes of population declines			Nighthawk,[2] Northern Rough-winged Swallow, Purple Martin, Tree Swallow
		Improve population/ demographic monitoring of aerial insectivores.	7.1 Improve population/ demographic monitoring	Encourage volunteer participation in Project NestWatch to increase data on nesting activity and to improve understanding of changes in productivity.	8.2 Monitoring	Bank Swallow, Northern Rough-winged Swallow, Purple Martin, Tree Swallow
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Barn Swallow, Common Nighthawk
Lack of knowledge (trend, population size, and/or distribution range).	12.1 Information lacking	Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend for colonial nesters and crepuscular species not well sampled by the Breeding Bird Survey.	8.2 Monitoring	Bank Swallow, Common Nighthawk[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk
Management of Nuisance Species						
Conservation Issue: Increasing conflicts between geese and human activities (e.g., agriculture) due to very abundant Eastern Temperate-breeding Canada Geese.	***Objective:*** Reduce human-goose conflicts.	3.6 Reduce overabundant species	Implement strategies within *A Management Plan for Temperate-breeding Canada Geese in Ontario* (Environment Canada, in prep.)	3.1 Species management	Canada Goose (Eastern Temperate-breeding population)	
			Undertake compliance promotion of *Migratory Birds Regulations* and provide advice for stakeholders and the public.	5.4 Compliance and enforcement		

Bare Areas

In BCR 12 ON, habitats classified as bare include open shorelines or coastal bare areas such as beaches and bare rock (including islands), exposed earthen banks, and sand and gravel pits. The region includes nearly 19 000 km of lake shorelines; beaches and innumerable islets near the shore offer bare habitats for several priority species such as the endangered *circumcinctus* Piping Plover or the Herring Gull. Although widespread, bare habitats are typically restricted in area, and account for only 1% of the provincial land cover (Fig. 19; Table 1).

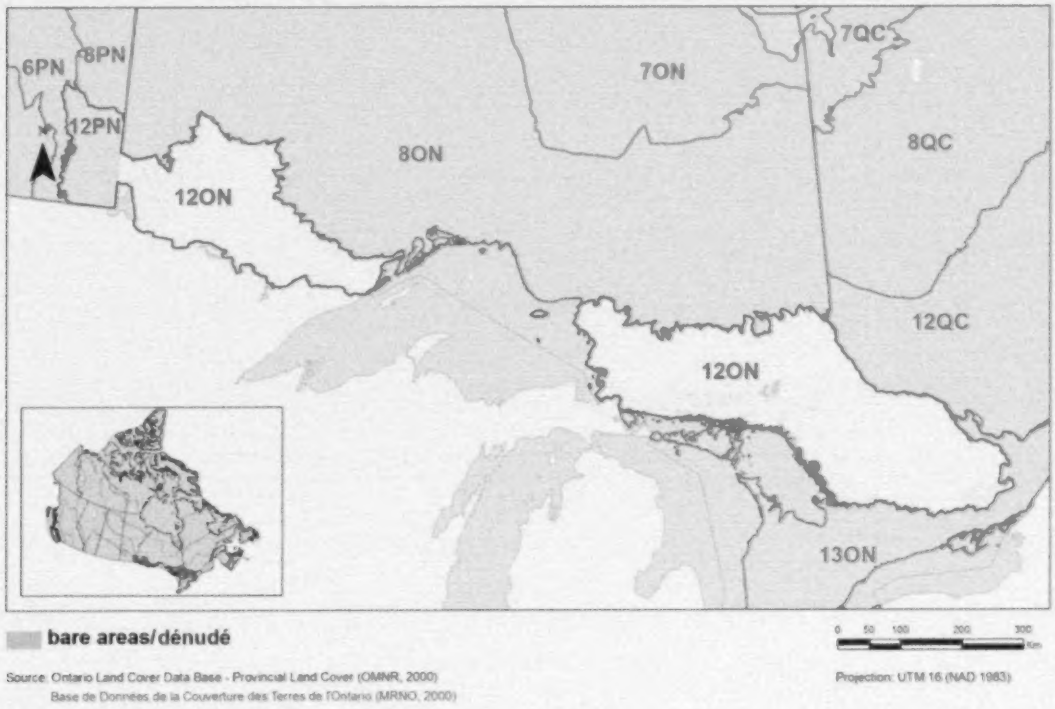

Figure 19. Map of bare areas in BCR 12 ON.

The 15 priority species (Table 16) using these habitats can be divided into several groups and each faces a suite of unique threats. The Spotted Sandpiper, the Cliff Swallow, the Piping Plover (*circumcinctus*) the Common and Caspian Terns, the Peregrine Falcon (*anatum/tundrius*), and the Great Black-backed and Herring Gulls are all priority species that nest along open shorelines (coastal bare areas) and/or on cliffs and bare islands. The loss and degradation of shoreline habitats owing to urban (including recreational property) development (sub-category 1.1) was assessed as a high-magnitude threat in part due to the number of species at risk using these habitats (Fig. 20). Piping Plovers are endangered provincially and federally and are extremely rare and localized breeders in Ontario. Recent known breeding locations in BCR 12 ON include two sites in Lake of the Woods: Windy Point, where young fledged successfully in 2009, and Sable Islands Provincial Nature Reserve, where in 2007 there was a failed breeding attempt (Environment Canada 2011). Actions to conserve this species and the Peregrine Falcon (*anatum/tundrius*), listed as Special Concern, appear in federal and provincial recovery

documents. However, recommended actions that seek to protect important nesting and/or stopover habitats for priority species will also benefit species at risk (Table 17).

Table 16. Priority species that use bare habitats in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Bank Swallow	Exposed earthen banks, sand and gravel pits	Increase	Y			Y			
Belted Kingfisher	Earthen banks near water; coastal bare areas	Increase					Y		
Caspian Tern	Coastal bare areas; islands	Increase				Y			
Cliff Swallow	Open canyons, foothills, escarpments	Increase				Y			
Common Nighthawk	Alvars; rock outcrops, sand barrens	Recovery objective†	Y	Y	Y	Y		Y	
Common Tern	Coastal bare areas; islands	Maintain current				Y		Y	
Great Black-backed Gull	Beaches; islands; offshore rocks	Assess/Maintain				Y			
Herring Gull	Beaches; islands; offshore rocks	Maintain current				Y		Y	
Killdeer	Open shorelines, beaches, mudflats	Increase				Y		Y	
Northern Rough-winged Swallow	Exposed earthen banks, sand and gravel pits, open shorelines	Increase				Y			
Peregrine Falcon (*anatum/tundrius*)	Beaches; open shoreline; cliff ledges or crevices	Recovery objective	Y	Y	Y	Y		Y	
Piping Plover (*circumcinctus*)	Gravelly beaches	Recovery objective	Y	Y	Y	Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objective for Common Nighthawk in BCR 12 ON is: Assess/Maintain.

Table 16 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Purple Martin	Open shorelines for foraging	Increase				Y			
Red Knot (*rufa*)	Beaches; mudflats	Migrant (no BCR 12 ON population objective)	Y	Y	Y	Y		Y	
Spotted Sandpiper	River banks; open shoreline; islands, sand and gravel pits	Maintain current				Y		Y	

Caspian and Common Terns nest colonially on islands. Competition for nesting sites with more numerous waterbirds such as Ring-billed Gulls or Double-crested Cormorants were considered to be threats of medium magnitude to these terns (sub-category 8.2). Threats associated with disturbance from recreational activities (sub-category 6.1) were determined to be of high magnitude to several colonial species due to the potential for abandonment of nests or tern colonies, and as a result, lower nesting success. Management of abundant species such as cormorants for the benefit of less abundant waterbirds is recommended, as is increasing the awareness of the effects of human activities on priority species.

Bank Swallows, Northern Rough-winged Swallows and Belted Kingfishers nest in exposed earthen banks, and these species are susceptible to the loss of these unique habitats to development or sand and gravel extraction (threat sub-category 3.2; Fig. 20). Recommended actions to mitigate these threats focus on the implementation of BMP guidelines for the protection of bank-nesting species by municipalities and the private sector (Table 17).

The *rufa* Red Knot is a long-distance migrant shorebird that breeds in the Arctic and winters in Central and South America. It stops along the shoreline habitats of the Great Lakes to forage and gain mass prior to continuing its migration. This population of Red Knot is endangered in Ontario and nationally. Also, recent analyses suggest that counts of shorebirds migrating through Ontario may have declined by more than 75% since the 1970s (Ross et al. 2012), highlighting shorebirds in general as the subject of significant conservation concern. The full extent to which the Red Knot and other migrant shorebirds use bare areas in BCR 12 ON, however, is unknown, as are the magnitudes of threats they might face there. To address this and other information gaps (sub-category 12.1), research and monitoring objectives were identified that focus on gathering ecological and demographic information for specific priority species or groups of species in the region (Table 17).

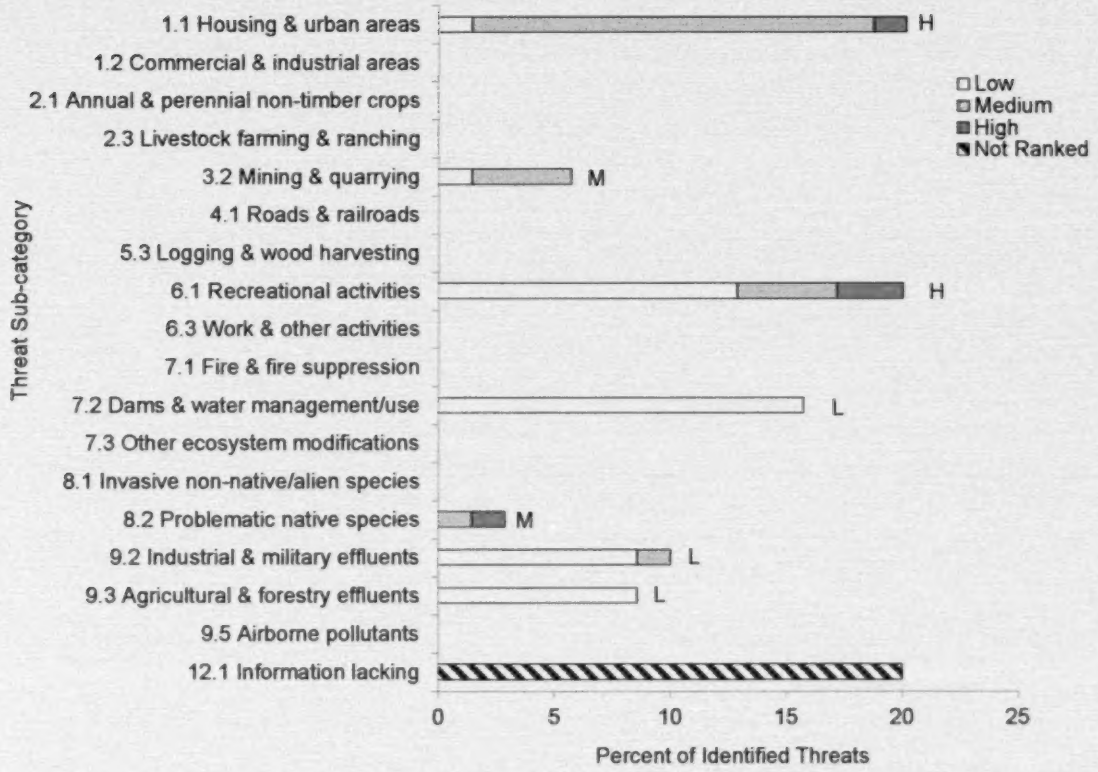

Figure 20. Percent of identified threats to priority species in bare areas habitat in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in bare habitat (for example, if 100 threats were identified in total for all priority species in bare areas, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H in the sub-category. The overall magnitude of the threat in bare areas is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 17. Threats addressed, conservation objectives, recommended actions and list of priority species affected in bare habitats in BCR 12 ON.
Note: Issues such as collisions with human-made structures (threats sub-category 1.2 Commercial and industrial areas) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of bare habitats due to urban development.	1.1 Housing & urban areas	Identify, protect and maintain important nesting and/or foraging sites and important migration stopover areas.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Protect important nesting/stopover habitats for priority birds.	1.1 Site/area protection	Bank Swallow, Belted Kingfisher, Caspian Tern, Cliff Swallow, Common Tern, Great Black-backed Gull, Herring Gull, Northern Rough-winged Swallow, Spotted Sandpiper, Killdeer
				Include BMP guidelines for the protection of coastal bare habitats for breeding and migrating birds in municipal planning; establish guidelines/rules for visitors to protected areas.	5.3 Private sector standards and codes	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Piping Plover (*circumcinctus*)
Habitat loss and/or degradation from the extraction of sand and gravel.	3.2 Mining & quarrying	Protect, manage and maintain important nesting sites.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Include guidelines for the protection and management of bank-nesting species, such as Belted Kingfisher and Bank Swallow, in BMPs for municipalities and operators of sand and gravel pits (e.g., Ontario Stone, Sand and Gravel Association 2013). Include habitat restoration for priority species into post-mining remediation or closure plans.	5.3 Private sector standards and codes	Bank Swallow, Belted Kingfisher, Northern Rough-winged Swallow

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.

Table 17 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Decrease in habitat quality due to human activity and recreation.	6.1 Recreational activities	Minimize human disturbance of priority species in bare habitats.	4.1. Reduce disturbance from human recreation	Develop education and outreach initiatives to increase public awareness (e.g., signage) of the potential influences of human activities on priority species and their habitats.	4.3 Awareness and communications	Caspian Tern, Bank Swallow, Killdeer
				Investigate extent of impact of recreational activities on breeding birds.	8.1 Research	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Peregrine Falcon (*anatum/ tundrius*), Piping Plover (*circumcinctus*)
Competition with other colonial waterbirds for nesting habitat (such as large Ring-billed Gull and Cormorant colonies).	8.2 Problematic native species	Reduce competition with Ring-billed Gulls and Double-crested Cormorants.	3.2 Reduce competition with problematic native species	Implement population management procedures (e.g., egg-oiling, substrate modification) under approved permits as required (Quinn, J.S. et al. 1996; Morris R.D. et al 2011).	2.2 Invasive/ problematic species control	Caspian Tern, Common Tern
Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants.	9.2 Industrial & military effluents	Meet the legal requirements for a federal/provincial species at risk.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Piping Plover (*circumcinctus)*
Lack of information on factors causing population declines.	12.1 Information lacking	Determine sources of mortality or population decline(s).	7.4 Improve understanding of causes of population declines	Implement research and monitoring priorities described within the *Ontario Shorebird Conservation Plan* (Ross et al. 2003).	8.1 Research	Killdeer, Spotted Sandpiper
				Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	8.1 Research	Bank Swallow, Cliff Swallow, Common

Table 17 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
						Nighthawk,[2] Northern Rough-winged Swallow, Purple Martin
		Improve population/demographic monitoring of aerial insectivores.	7.1 Improve population/ demographic monitoring	Encourage volunteer participation in Project NestWatch to increase data on nesting activity and to improve understanding of changes in productivity.	8.2 Monitoring	Bank Swallow, Cliff Swallow, Northern Rough-winged Swallow, Purple Martin
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk, Red Knot (rufa)
Lack of knowledge (trend, population size, and/or distribution range).		Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/ demographic monitoring	Evaluate alternative monitoring strategies for filling gaps in coverage for colonial waterbirds.	8.2 Monitoring	Caspian Tern, Common Tern, Great Black-backed Gull, Herring Gull
				Improve monitoring efforts to increase reliability of population status/trend for Bank Swallows (colonial nesters) and Common Nighthawk (crepuscular species) not well sampled by the Breeding Bird Survey.		Bank Swallow, Common Nighthawk[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Common Nighthawk

[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Urban

The human population of BCR 12 ON is well below 1 million (a total of 700 000 residents overall in 2005; Ontario Ministry of Finance 2005). Much of this population is concentrated in the urban centres of North Bay, Sault St. Marie, Sudbury and Thunder Bay. There are approximately 125 000 hectares (< 1%) of provincial land cover class "settlement /infrastructure" in BCR 12 ON; because this category includes infrastructure such as hydro-transmission corridors, it is an overestimate of the true extent of urban habitat (Fig. 21; Table 1). Rooftops, roadsides, human-built structures (e.g., bridges) and other urban habitats are used by numerous species of birds to some extent, but comparatively few priority species use these areas extensively or preferentially, especially during the breeding season. However, six priority species have adapted to nest on or in artificial structures: the Barn Swallow, the Canada Goose (Eastern Temperate-breeding population), the Chimney Swift, the Common Nighthawk, the Killdeer and the Peregrine Falcon (*anatum/tundrius*; Table 18).

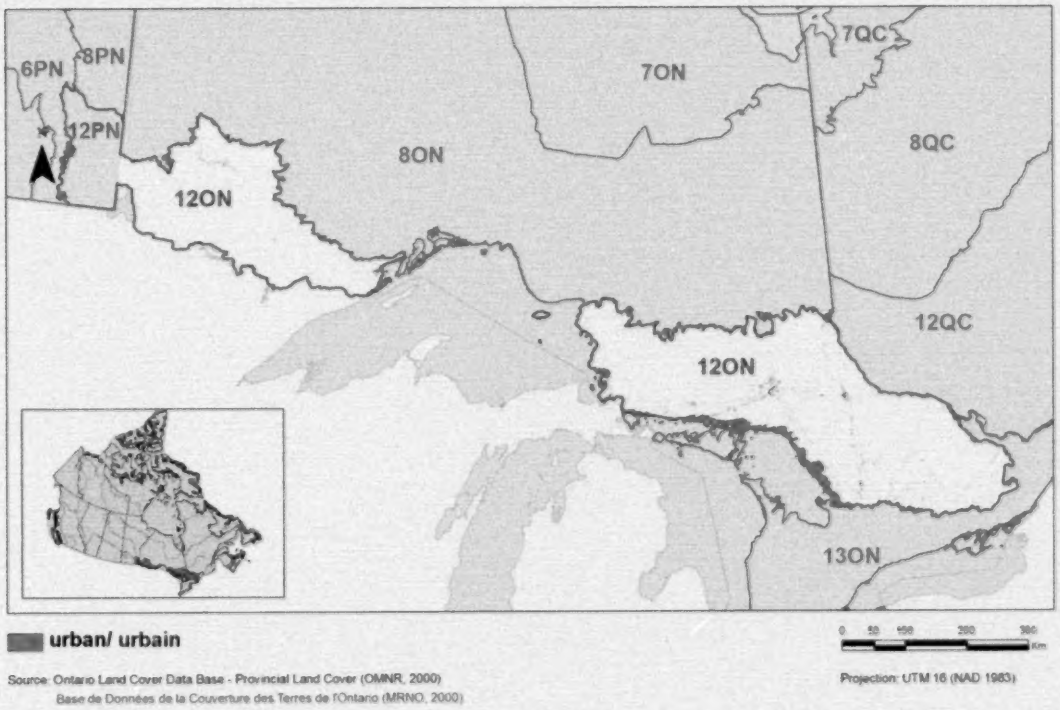

Figure 21. Map of urban habitats in BCR 12 ON.

Chimney Swifts, a species at risk listed as Threatened federally and provincially, once roosted and bred in large, hollow trees. The disappearance of these snags as land was cleared through the 19th and early 20th century coincided with the widespread appearance of brick chimneys. The species adapted to roost in these and other human-built structures, but the disappearance of many brick chimneys and the capping of others (threat sub-category 1.1) have reduced the availability of these structures to the species (COSEWIC 2007c). Actions to address this threat

include identifying and protecting key urban roosting and nesting sites, and targeted monitoring and research (sub-category 12.1) to better understand the reason(s) for the population decline, as well as the distribution and population trends of this and other priority aerial insectivore species (Table 19).

The Killdeer, one of the most common and familiar North American shorebirds, has demonstrated declines in parts of the province (Cadman et al. 2007). This priority species has also adapted to breeding in anthropogenic habitats such as gravel rooftops, roadsides and building sites. As a result of their close association with humans, Killdeer are particularly vulnerable to disturbance and the adverse impacts of human activities (sub-category 6.3). Raising public awareness of the vulnerability of this and other priority species to human disturbance at nesting sites and establishing buffer zones around known nesting sites are recommended actions to mitigate threats from disturbance (Table 19).

The Canada Goose is also a familiar bird in urban settings, inhabiting parks and other urban green spaces near water. The Eastern Temperate-breeding population of Canada Goose has been so successful at adapting to this environment that its large population size now brings it into frequent conflict with humans (see the Cultivated and Managed section for further details). Management strategies to reduce these conflicts are being defined in a Management Plan for Temperate-Breeding Canada Geese in Ontario (Environment Canada, in prep.), and implementing the recommendations of this strategy was identified as a key management action for this species (Table 19).

The full list of threats to and information needs (sub-category 12.1) for priority species in urban habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 19.

Table 18. Priority species that use urban habitats in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Barn Swallow	Rural and settled landscapes; artificial surfaces (barns, buildings and bridges)	Recovery objective	Y		Y	Y			
Canada Goose (Eastern Temperate-breeding population)	Managed green spaces; lawns, parks, golf courses, adjacent to water	Decrease				Y			
Chimney Swift	Artificial surfaces (chimneys, walls, rafters, building gables)	Recovery objective†	Y	Y	Y	Y			
Common Nighthawk	Artificial surfaces (gravel areas including rooftops, occasionally railways)	Recovery objective†	Y	Y	Y	Y		Y	
Killdeer	Artificial surfaces (gravel areas including rooftops, road edges)	Increase				Y		Y	
Peregrine Falcon (*anatum/tundrius*)	Bare areas; artificial surfaces (ledges of tall building or bridges)	Recovery objective	Y	Y	Y	Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
† Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Chimney Swift: Increase; Common Nighthawk: Assess/Maintain.

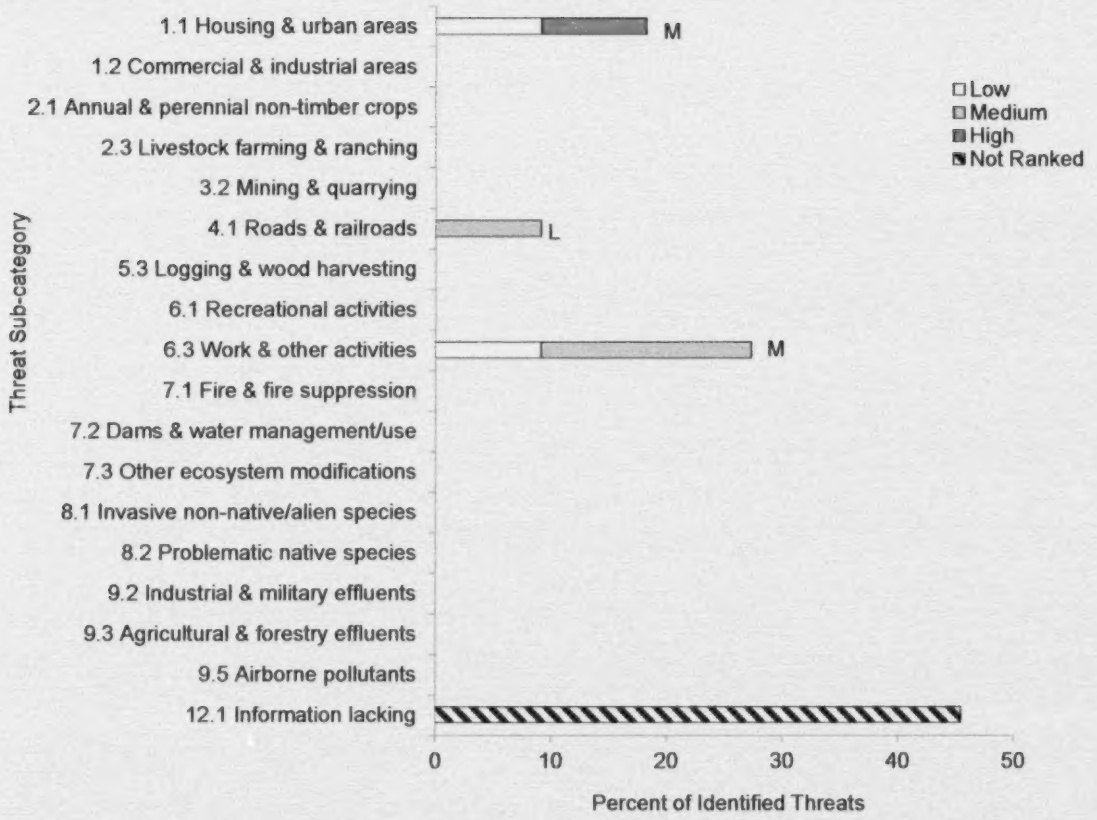

Figure 22. Percent of identified threats to priority species in urban habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in urban habitat (for example, if 100 threats were identified in total for all priority species in urban habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category). The overall magnitude of the threat in urban habitats is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 19. Threats addressed, conservation objectives, recommended actions and list of priority species affected in urban habitats in BCR 12 ON.

Note: Issues such as collisions human-made structures and vehicles (threats sub-category 1.2 Commercial and industrial areas and 4.1 roads and railroads) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss of nesting habitat due to demolition of chimneys or installation of screening/loss of hollow trees.	1.1 Housing & urban areas	Identify and protect nesting and roosting sites.	1.4 Maintain important bird features on the landscape	Identify, monitor and, where feasible, protect existing nesting and roosting sites in urban areas (e.g., hollow trees and unlined chimneys). (Ontario Partners in Flight 2008). Research and develop effective artificial nesting towers for use on building rooftops where existing chimneys are capped.	2.1 Site/area management	Chimney Swift[2]
				Increase awareness of the importance of chimneys and hollow trees as nesting and roosting sites for Chimney Swifts.	4.3 Awareness and communications	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Disturbance at nest sites from human development.	6.3 Work & other activities	Reduce disturbance at nesting sites.	4.2 Reduce disturbance from industrial or work activity	Raise public awareness of the vulnerability of this species to human disturbance at nesting sites.	4.3 Awareness and communications	Killdeer,
				Develop BMPs (e.g., determine setback distances to provide "buffer zones" for nesting birds) as a means to reduce disturbance.	5.3 Private sector standards and codes	
		Meet the legal requirements for a	3.4 Implement recovery strategies for	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Barn Swallow, Peregrine Falcon (*anatum/*

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.

[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 19 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		federal/provincial Species at Risk legislation.	species at risk			*tundrius*)
Lack of information on factors causing population declines.	12.1 Information lacking	Determine sources of mortality or population decline(s).	7.4 Improve understanding of causes of population declines	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	8.1 Research	Chimney Swift,[2] Common Nighthawk[2]
		Increase understanding of breeding, wintering and migration ecology to determine limiting factors.	7.4 Improve understanding of causes of population declines	Conduct breeding, wintering and migration ecology studies focusing on the availability of nest sites and post-breeding roosts, and the impact of weather and food availability on productivity and survival (Chimney Swift).	8.1 Research	Chimney Swift[2]
		Improve population/ demographic monitoring of aerial insectivores.	7.1 Improve population/demographic monitoring	Encourage volunteer participation in Project NestWatch to increase data on nesting activity and to improve understanding of changes in productivity.	8.2 Monitoring	Chimney Swift[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Barn Swallow, Chimney Swift, Common Nighthawk,
Lack of knowledge (trend, population size, and/or distribution range.		Improve monitoring efforts to increase reliability of	7.1 Improve population/ demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend for species not well sampled by the Breeding Bird Survey.	8.2 Monitoring	Common Nighthawk[2]

Table 19 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		population status/trend.				
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	
Management of Nuisance Species						
Conservation Issue: Increasing conflicts between geese and human activities (e.g., agriculture) due to very abundant Eastern Temperate-breeding Canada Geese.		***Objective:*** Reduce human-goose conflicts	3.6 Manage nuisance species	Implement strategies within *A Management Plan for Temperate-breeding Canada Geese in Ontario* (Environment Canada, in prep.).	3.1 Species management	Canada Goose (Eastern Temperate-breeding population)

Wetlands

Under the LCCS, wetlands include vegetated habitats that are aquatic or regularly flooded, such as bogs, fens, swamps, marshes and shallow water areas. Inland marshes represent a transitional zone in the provincial land cover data and cannot be effectively differentiated; as such, there is no corresponding area attributed to this class. Furthermore, swamp classes are routinely greatly underestimated as they are difficult to differentiate from forest classes (Spectranalysis Inc. 2004). Acknowledging these limitations, wetlands were determined to account for a minimum of 2% of the land cover of BCR 12 ON, and they are used extensively (but not necessarily exclusively) by the most (28%) priority species, seven of which are species at risk (Fig. 23; Table 20).

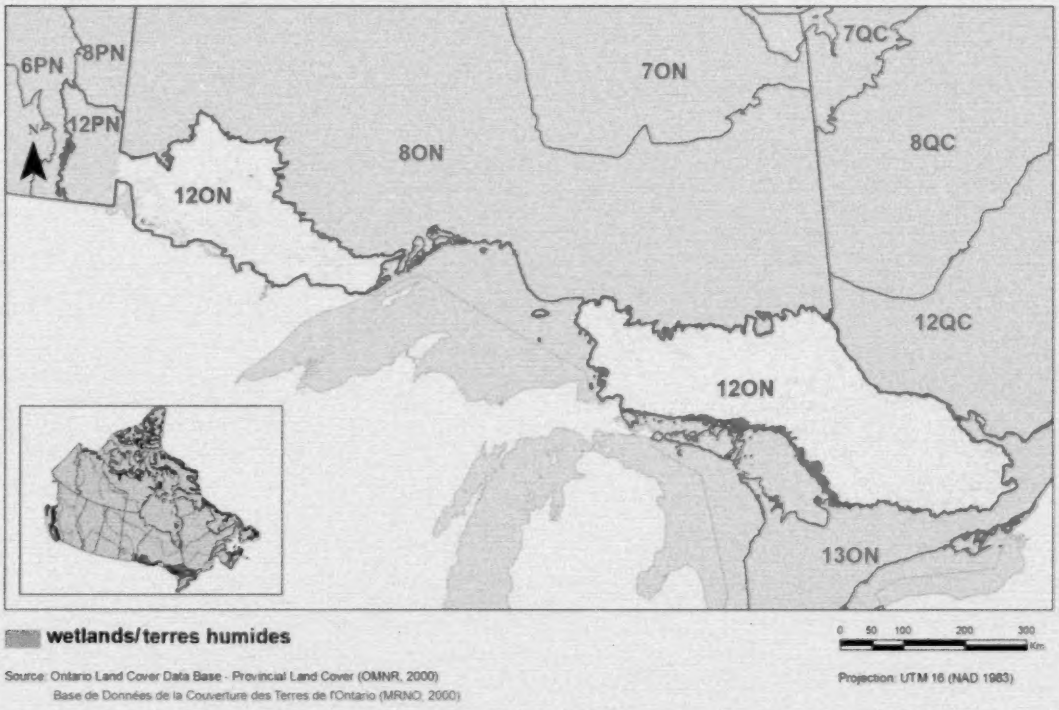

Figure 23. Map of wetland habitats in BCR 12 ON.

Table 20. Priority species that use wetland habitats in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American Black Duck	Riverine marshes , bogs, wooded swamps, beaver ponds	Increase				Y		Y	
American Coot	Large, deep water cattail marshes	Maintain current				Y			
Black Tern	Coastal marshes; marshes	Recovery objective			Y	Y		Y	
Black-crowned Night-Heron	Marshes; swamps	Assess/Maintain				Y			
Bufflehead	Small lakes and wetlands with forested shorelines	Maintain current				Y			
Canada Goose (Southern James Bay population)	Coastal marshes; marshes	Migrant (no BCR 12 ON population objective)				Y		Y	
Canada Goose (Eastern Temperate-breeding population)	Coastal marshes; marshes	Decrease				Y			
Caspian Tern	Coastal marshes	Increase				Y			
Common Gallinule	Large marshes with open water and tall emergent vegetation	Assess/Maintain				Y			
Common Yellowthroat	Marshes; bogs; swamps	Maintain current					Y		
Connecticut Warbler	Fairly open swamps; bogs; tamarack-spruce fens	Increase				Y		Y	Y

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[†] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Horned Grebe (western population): Assess/Maintain; Olive-sided Flycatcher: Increase; Rusty Blackbird: Increase.

Table 20 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Green Heron	Marshes; swamps	Increase				Y			
Green-winged Teal	Marshes, bogs, fens, beaver meadows	Maintain current				Y			
Horned Grebe (western population)	Marshes and shallow bays	Recovery objective†	Y		Y	Y		Y	
Least Bittern	Marshes dominated by emergent vegetation with open water	Recovery objective	Y	Y	Y	Y		Y	
Louisiana Waterthrush	Clear headwater streams and associated wetlands; heavily wooded swamps	Recovery objective	Y	Y	Y	Y		Y	Y
Mallard	Marshes, beaver ponds, swamps	Maintain current				Y		Y	
Olive-sided Flycatcher	Bogs; fens; tall trees in expansive bogs	Recovery objective†	Y	Y	Y	Y		Y	
Red-necked Grebe	Marshes	Assess/ Maintain				Y			
Ring-necked Duck	Swamps; fens; bogs; beaver ponds; coastal marshes for staging	Maintain current				Y			
Rusty Blackbird	Wooded swamps; peat bogs, beaver ponds, marshes	Recovery objective†	Y	Y		Y		Y	
Sandhill Crane	Marshes and wet sedge fens	Assess/ Maintain				Y			
Sedge Wren	Wet sedge meadows with scattered shrubs	Maintain current					Y		
Solitary Sandpiper	Marshes, beaver ponds	Assess/ Maintain				Y		Y	
Swamp Sparrow	Marshes, wet bogs or fens with open water dominated by sedges and low shrubs	Maintain current					Y	Y	Y
Wilson's Snipe	Bogs; fens; willow swamp; wet meadows; marshes	Assess/ Maintain				Y			
Wood Duck	Deciduous tree swamps; beaver ponds	Maintain current				Y			
Yellow Rail	Marshes dominated by sedges	Recovery objective	Y	Y	Y	Y		Y	

Wetland habitats in BCR 12 ON are exposed to the greatest variety and number of threats, more so than any other habitat class. Threats to priority species were assessed as medium or high in 9 out of 17 threat sub-categories (Fig. 24).

Loss of wetland habitats to agriculture, development, water diversion and other land use change are common issues across much of the country. For example, in BCR 13 ON to the south, 90% of wetlands have been lost to agriculture or development in some portions of the region (Snell, 1987). In BCR 12 ON, where human development and agriculture are less widespread, loss of wetlands to agriculture was low (sub-category 2.1). Urban development (sub-category 1.1) was considered to be a medium threat for most priority species, but a high magnitude overall (Fig. 24; Table 21). Wetlands along the Great Lakes coast are critical staging habitat for migratory waterfowl and shorebirds, and breeding habitat for many waterbirds, including the Threatened Least Bittern and the Black Tern (of Special Concern). Suggested actions to address loss and degradation of wetlands include direct protection for key habitats (e.g., coastal wetlands), the development of BMPs that support wetland habitat conservation and restoration by all sectors, and the promotion of wetland conservation and ecosystem services as a means to maintaining a healthy environment (Table 21).

The region's numerous interior wetlands are affected directly and indirectly by forestry activities in a number of ways that in turn adversely affect priority birds. Loss of cavity trees near wetlands for nesting, disturbance from logging activities, and water quality effects were all determined to have population-level effects of varying magnitudes on priority birds (sub-categories 5.3 and 6.3; Fig. 24). Establishing or expanding buffers around wetlands is a key management action to reduce these adverse effects on priority birds (Table 21). The OMNR Stand and Site Guide provides more specific direction to minimize disturbance of wetland habitats by forestry activities, protect hydrological linkages between upland and lowland areas, and to meet species-specific objectives (Ontario Ministry of Natural Resources 2010b).

Southern Ontario has more established invasive non-native species than any other Canadian province or territory (Ontario Biodiversity Council 2010). Habitat loss and/or degradation from the invasive non-native herbaceous perennial, purple loosestrife (*Lythrum salicaria*), was ranked as a high overall magnitude threat for wetland habitats in BCR 12 ON (sub-category 8.1; Fig. 24). Purple loosestrife was introduced to North America from Eurasia in the early 1800s, and not only does it outcompete native vegetation and decrease plant and vertebrate diversity, it also affects nutrient cycling and causes drying, which ultimately reduces the quality of wetlands for birds and other wildlife (Federal, Provincial and Territorial Governments of Canada 2010). Key actions to mitigate threats from invasive non-native species include prevention through increased awareness and regulatory measures, as well as monitoring the spread of introduced species (Table 21).

Habitat loss, degradation and disturbance by construction and maintenance of transportation networks in BCR 12 ON was assessed as a medium overall threat in wetland habitats (sub-category 4.1). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. In BCR 12 ON, road densities are highest in the south-eastern portion and in the vicinity of urban centres (Ontario Biodiversity Council 2010). The construction of new and maintenance of both forest access roads and roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including mortality from collisions with vehicles, individual species disruption attributed to

noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended conservation actions in wetland habitats seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation. The Widespread Issues section of this strategy addresses collisions with vehicles in more detail.

Acid precipitation (sub-category 9.5) was identified as a threat of high magnitude overall for aquatic ecosystems within BCR 12 ON, but most notably in waterbodies. Acid rain primarily affects sensitive bodies of water, which are located in watersheds whose soils have a limited ability to neutralize acidic compounds. Wetlands adjacent to or associated with acid-sensitive lakes, streams and rivers are also likely to be affected by acid deposition, degrading the quality of aquatic habitats and reducing the availability of prey (e.g., aquatic invertebrates) for priority species. The continued implementation of international air quality agreements that reduce acid precipitation is a critical conservation action for priority birds that forage in aquatic habitats in BCR 12 ON (Table 21).

Degradation of wetland habitats due to direct sources of pollutants from forestry and industry (threat sub-categories 9.3 and 9.2 respectively) poses a significant threat to priority birds in some portions of the region where these activities occur. As with other aquatic habitats, conservation actions focus on restoring or enhancing wetland habitat quality by buffering wetlands from stressors, working with industry and policy-makers to reduce the quantity of toxic chemicals released into the environment, as well as monitoring and enforcing compliance with laws, policies and regulations at all levels (Table 21).

The full list of threats to and information needs (sub-category 12.1) for priority species in wetland habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 21.

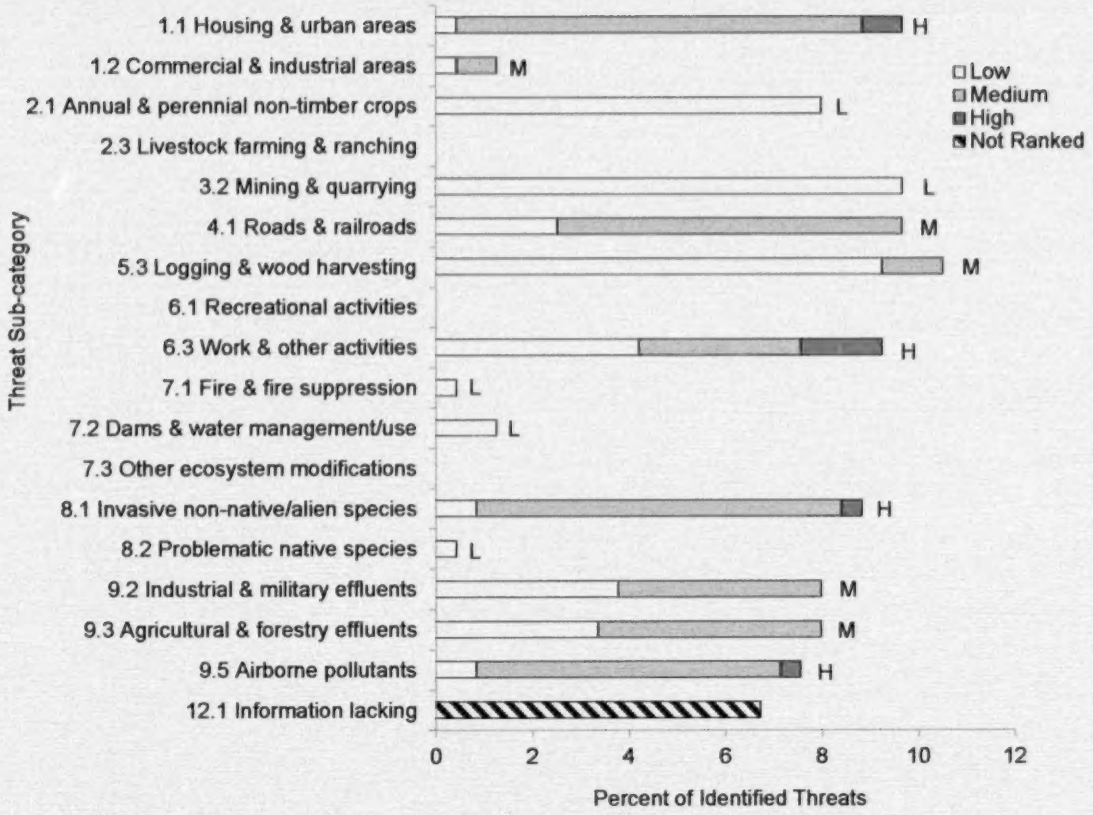

Figure 24. Percent of identified threats to priority species in wetland habitats in each threat sub-category by magnitude.

Each bar represents the percent of the total number of threats identified in each threat sub-category in wetland habitat (for example, if 100 threats were identified in total for all priority species in wetland habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category). The overall magnitude of the threat in wetland habitats is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 21. Threats addressed, conservation objectives, recommended actions and list of priority species affected in wetland habitats in BCR 12 ON.
Note: Issues such as collisions with human-made structures and vehicles (threats sub-category 1.2 Commercial and industrial areas and 4.1 roads and railroads) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of wetland habitat due to urban development.	1.1 Housing & urban areas	Maintain, enhance or restore the quantity, quality and diversity of wetlands across the landscape.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Identify and protect important nesting/stopover wetland habitats for priority birds.	1.1 Site/area protection	American Black Duck, American Coot, Black-crowned Night-Heron, Bufflehead, Caspian Tern, Common Gallinule, Connecticut Warbler, Green Heron, Green-winged Teal, Olive-sided Flycatcher,[2] Red-necked Grebe, Ring-necked Duck, Rusty Blackbird,[2] Sandhill Crane, Sedge Wren, Solitary Sandpiper, Swamp Sparrow, Wilson's Snipe, Wood Duck
				Protect wetlands of a variety of sizes, configuration and habitat conditions (e.g., emergent cover, water level, hydroperiods) in order to ensure a diversity of sub-habitat types and species across the landscape.	1.2 Resource and habitat protection	
				Ensure presence of important bird features such as cavity nesting trees, natural vegetation cover (as appropriate to the priority species).	2.3 Habitat and natural process restoration	
				Promote wetland conservation and ecosystem services as a means to maintaining a healthy environment.	4.3 Awareness and communications	
				Develop land-use policies and BMPs that support wetland habitat protection/restoration in all sectors (e.g., construction, agriculture, forestry, mining, wind power, and aggregate extraction).	5.3 Private sector standards and codes	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern, Olive-sided Flycatcher, Rusty Blackbird, Yellow Rail
Habitat loss/ degradation and disturbance by construction and	4.1 Roads & railroads	Reduce/eliminate habitat loss and degradation from the construction and maintenance of roads and	1.1 Ensure land and resource-use policies and practices maintain or	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation and/or degradation from road construction and maintenance of road networks .	5.3 Private sector standards and codes	American Black Duck, Bufflehead, Common Gallinule, Common Yellowthroat, Connecticut Warbler, Green Heron, Green-winged Teal, Olive-

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
maintenance of transportation networks.		associated infrastructure.	improve bird habitat			sided Flycatcher,[2] Red-necked Grebe, Ring-necked Duck, Rusty Blackbird,[2] Sandhill Crane, Wood Duck, Wilson's Snipe
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern, Olive-sided Flycatcher, Rusty Blackbird, Yellow Rail
Alteration of habitat quality/ loss of nesting cavities in some areas.	5.3 Logging & wood harvesting	Maintain/restore important bird features in wetland habitat.	1.4 Maintain important bird features on the landscape	Create a system of protected areas that represent the size, shape and spatial arrangement of all wetland ecosites at a regional scale.	1.1 Site/area protection	Bufflehead, Wood Duck
				Maintain a >200 m wide vegetated area around all wetlands to minimize the changes to hydrology associated with adjacent land-uses, and to provide upland habitat for nesting birds (Pearce 2011).	2.1 Site/area management	
				Retain greater than or equal to 10 living cavity trees or large stubs per hectare with a minimum of 5 living cavity trees on each hectare within 30 m of the wetland perimeter; or provide nest boxes if suitable nest trees are not available (Bufflehead, Wood Duck; Pearce 2011).	2.3 Habitat and natural process restoration	
				Ensure that linkages continue to be developed and maintained between bird conservation and forest management planning policies.	7.2 Alliance and partnership development	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Louisiana Waterthrush
Disturbance from resource extraction activities.	6.3 Work & other activities	Reduce/eliminate human disturbance.	4.2 Reduce disturbance from industrial or	Critical Function Zones (CFZ) should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zones (PZ) should protect or buffer the wetland	2.1 Site/area management	American Black Duck, American Coot, Black-crowned Night-Heron, Bufflehead, Caspian Tern,

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
			work activity	attributes from stressors. Recommended zone widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013b).		Red-necked Grebe, Ring-necked Duck, Sandhill Crane, Wilson's Snipe, Wood Duck
				Raise awareness about the effect of human disturbance on priority bird species.	4.3 Awareness and communications	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern
Habitat loss and/or degradation due to invasive non-native species (e.g., Purple loosestrife).	8.1 Invasive non-native/alien species	Prevent and control the spread of invasive non-native species.	3.5 Prevent and control the spread of invasive and exotic species	Prevent the introduction and spread of invasive non-native species into aquatic ecosystems and develop eradication protocols for coordinated management efforts.	2.2 Invasive/ problematic species control	American Black Duck, American Coot, Black-crowned Night-Heron, Bufflehead, Caspian Tern, Common Gallinule, Green Heron, Green-winged Teal, Ring-necked Duck, Rusty Blackbird,[2] Sandhill Crane, Sedge Wren, Solitary Sandpiper, Swamp Sparrow, Wilson's Snipe, Wood Duck
				Raise public awareness of the need to prevent the introduction and spread of invasive non-native species.	4.3 Awareness and communications	
				Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species.	5.2 Policies and regulations	
				Encourage participation in volunteer monitoring efforts (e.g., *Invading Species Awareness Program*) to help address threats from invasive non-native species on aquatic habitats.	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern, Rusty Blackbird, Yellow Rail

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants.	9.2 Industrial & military effluents	Maintain, enhance or restore wetland habitat quality.	1.5 Reduce habitat degradation from contaminants	Critical Function Zone (CFZ) should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zone (PZ) should protect or buffer the wetland attributes from stressors. Recommended zone widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013b).	2.1 Site/area management	American Black Duck, Black-crowned Night-Heron, Bufflehead, Caspian Tern, Green Heron, Red-necked Grebe, Ring-necked Duck, Wood Duck
				Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	4.3 Awareness and communications	
				Work with industry and policy makers to reduce the quantity of toxic chemicals released into the environment. Encourage the inclusion of effective measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.	5.2 Policies and regulations	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern
Mortality, sub-lethal effects, reductions in prey populations,	9.3 Agricultural & forestry effluents	Maintain/improve wetland habitat quality by reducing pesticide use.	5.1 Maintain natural food webs and prey sources	Critical Function Zone (CFZ) should be established around wetlands based on knowledge of species present and their use of habitat types. Protection Zone (PZ) should protect or buffer the	2.1 Site/area management	American Black Duck, American Coot, Black-crowned Night Heron, Bufflehead, Caspian Tern, Common Gallinule,

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
and habitat alteration caused by exposure to or use of pesticides.				wetland attributes from stressors. Recommended zone widths should consider sensitivities of the wetland and the species that depend upon it, as well as local environmental conditions (e.g., slopes, soils and drainage), vegetative structure of the PZ, and nature of the changes in adjacent land uses. Stressors need to be identified and mitigated through PZ design (Environment Canada 2013b).		Green Heron, Olive-sided Flycatcher,[2] Red-necked Grebe
				Promote the use of IPM programs to reduce pesticide use.	5.3 Private sector standards and codes	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern, Olive-sided Flycatcher
Acid precipitation affects the availability of prey items and reduces the quality of aquatic habitats.	9.5 Airborne pollutants	Reduce emissions of air-borne pollutants.	1.5 Reduce habitat degradation from contaminants	Compliance promotion with existing air quality agreements.	5.4 Compliance and enforcement	American Black Duck, American Coot, Black-crowned Night-Heron, Bufflehead, Caspian Tern, Common Gallinule, Green Heron, Green-winged Teal, Olive-sided Flycatcher[2], Ring-necked Duck, Rusty Blackbird,[2] Wilson's Snipe, Wood Duck
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Least Bittern, Louisiana Waterthrush, Olive-sided Flycatcher, Rusty Blackbird

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Lack of knowledge (trend, population size, and/or distribution range).	12.1 Information lacking	Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/ demographic monitoring	Evaluate alternative monitoring strategies for filling gaps in coverage for shorebirds, colonial waterbirds and marsh birds.	8.2 Monitoring	American Coot, Black-crowned Night Heron, Caspian Tern, Common Gallinule, Green Heron, Horned Grebe (western population),[2] Olive-sided Flycatcher,[2] Red-necked Grebe, Solitary Sandpiper
				Expand monitoring effort to inform population management.		Sandhill Crane
				Improve monitoring efforts to increase reliability of population status/trend.		Connecticut Warbler, Olive-sided Flycatcher,[2] Rusty Blackbird[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Black Tern, Horned Grebe (western population), Olive-sided Flycatcher, Rusty Blackbird, Yellow Rail
Lack of information on factor(s) causing population decline.		Determine cause(s) of population decline.	7.4 Improve understanding of causes of population declines	Investigate potential causes of population decline including studying population demographics across a range of nesting sites and management regimes. (Ontario Partners in Flight 2008).	8.1 Research	Olive-sided Flycatcher[2]
				Investigate potential causes of population decline; improve understanding of breeding and wintering ecology (Ontario Partners in Flight 2008).		Rusty Blackbird[2]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Olive-sided Flycatcher, Rusty Blackbird
Management of Nuisance Species						
Conservation Issue: Increasing conflicts between geese and human activities		***Objective:*** Reduce human-goose conflicts.	3.6 Manage nuisance species	Implement strategies within *A Management Plan for Temperate-breeding Canada Geese in Ontario* (Environment Canada, in prep.).	3.1 Species management	Canada Goose (Eastern Temperate-breeding population)

Table 21 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
(e.g., agriculture) due to very abundant Eastern Temperate-breeding Canada Geese.				Continue to undertake compliance promotion of *Migratory Birds Regulations* and provide advice for stakeholders and the public.	5.4 Compliance and enforcement	

Waterbodies

In Ontario, BCR 12 borders two Great Lakes and includes innumerable other lakes and rivers. Open water habitats are used extensively by 21 priority species (Table 22). Some species in this list, such as the Long-tailed Duck and Canada Goose (Southern James Bay population) aggregate in nearshore waters of the Great Lakes during migration. Many gulls and terns breed on islands in the Great Lakes and use open water habitats to forage. Lakes and rivers (amounting to 15% of the region's land cover, excluding the Great Lakes) are also important foraging habitat for several fish-eating species, such as the Belted Kingfisher and Common Merganser (Fig. 25; Table 1.)

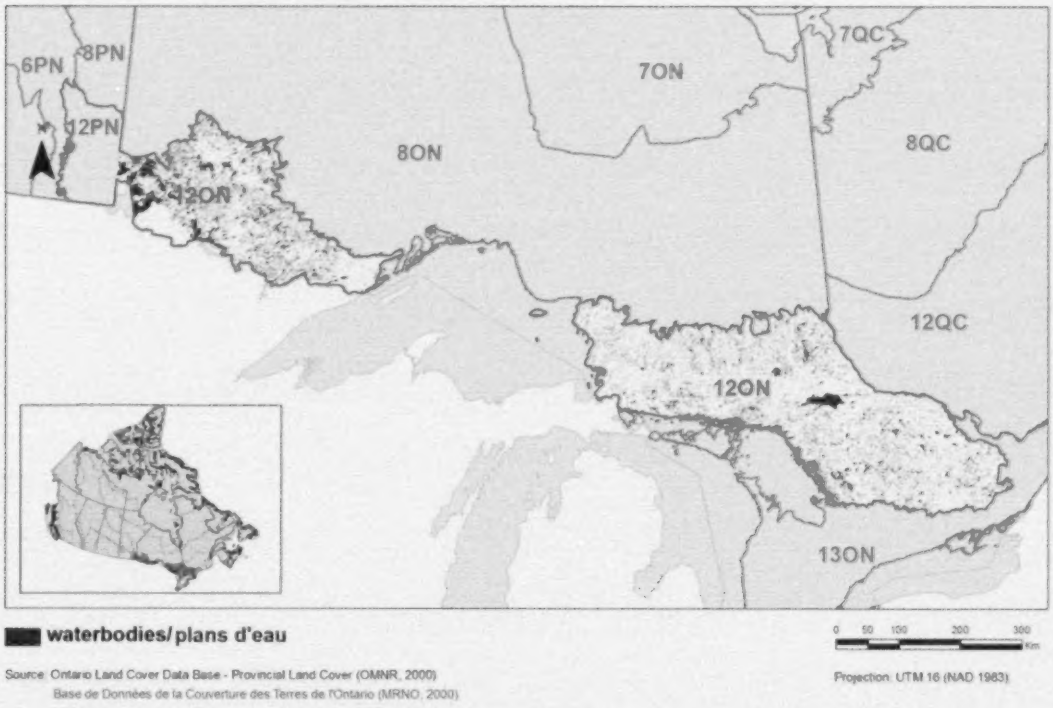

Figure 25. Map of waterbodies in BCR 12 ON.

Many of the waterbodies in this region are far removed from the direct effects of human development. Issues related to pollution (including pollutants transported over long distances) (Ontario Ministry of the Environment 2009; 2013) emerged as the most significant threats to priority birds in this habitat type (Fig. 26). Degradation of aquatic habitats due to direct sources of pollutants from forestry and industry (threat sub-categories 9.3 and 9.2 respectively) poses a significant threat to priority birds in some portions of the region where these activities occur. Some persistent, bioaccumulative and toxic substances, such as polychlorinated biphenyls (PCBs), pesticides and polybrominated diphenyl ethers (PBDEs), can pose a significant threat to fish-eating birds, but the threshold levels and effects are not entirely understood. Further

research to better understand these effects was identified as an important information need (Table 23).

Table 22. Priority species that use waterbodies in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
American White Pelican	Lakes; rivers; isolated islands	Recovery objective			Y	Y		Y	
Bald Eagle	Large lakes and rivers	Recovery objective[†]			Y	Y			Y
Belted Kingfisher	Lakes and rivers	Increase					Y		
Black Scoter	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y		Y	
Bufflehead	Lakes and rivers with forested shorelines	Maintain current				Y			
Canada Goose (Southern James Bay population)	Lakes; rivers for roosting	Migrant (no BCR 12 ON population objective)				Y		Y	
Caspian Tern	Large lakes	Increase				Y			
Common Goldeneye	Lakes and rivers with forested shorelines	Maintain current				Y		Y	
Common Merganser	Lakes and rivers with forested shorelines	Maintain current				Y			
Common Tern	Large lakes	Maintain current				Y		Y	

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[†] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Bald Eagle: Assess/Maintain; Horned Grebe: Assess/Maintain.

Table 22 continued

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Great Black-backed Gull	Lakes and rivers	Assess/Maintain				Y			
Greater Scaup	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y			
Herring Gull	Lakes and rivers	Maintain current				Y		Y	
Hooded Merganser	Lakes and rivers with forested shorelines	Maintain current				Y			
Horned Grebe (western population)	Lakes and rivers	Recovery objective[†]	Y		Y	Y		Y	
Lesser Scaup	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y		Y	
Long-tailed Duck	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y		Y	
Peregrine Falcon (*anatum/tundrius*)	Lakes and rivers	Recovery objective	Y	Y	Y	Y		Y	
Red-necked Grebe	Large lakes and bays (>2 ha)	Assess/Maintain				Y			
Surf Scoter	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y		Y	
White-winged Scoter	Large lakes for staging	Migrant (no BCR 12 ON population objective)				Y		Y	

Acid precipitation was identified as a threat of very high magnitude overall (sub-category 9.5), and affects priority species by degrading the quality of aquatic habitats or reducing the availability of prey. BCR 12 ON is underlain by the granite of the Precambrian Shield. The region's watersheds, therefore, have limited buffering capacity to neutralize acid precipitation, and some have been profoundly affected. Local effects of historic acid precipitation in the vicinity of Sudbury from nickel smelting emissions were ecologically devastating, denuding the area of vegetation by the 1950s and leading to the near-total collapse of aquatic food webs in some of the region's lakes. However, the risk is much more widespread than this. The emissions

causing acid precipitation are transported over long distances, and the threat of acid precipitation affects many lakes in the region with inadequate natural buffering capacity. Emissions levels contributing to acid precipitation have been reduced markedly in recent decades (Environment Canada 2010), but some lakes have yet to recover. Effects of acid precipitation include reduced abundance of invertebrates and fish, and in more severe cases, total absence of fish. The continued implementation of international air quality agreements that reduce acid precipitation is a critical conservation action for priority birds that forage in the waterbodies in BCR 12 ON (Table 23).

Some waterbodies within the region are heavily used for human recreation, and disturbance of breeding, staging and foraging birds due to recreation (sub-category 6.1) was identified as a medium threat to most priority species but a high magnitude overall (Fig. 26, Table 23). Although disturbances are localised in this sparsely populated region, recreational boating can lead to the desertion of nests or abandonment of roosting sites by staging birds. Minimizing or eliminating this disturbance requires the cooperation of the public and accordingly, actions focus on education and other efforts to increase awareness about the effects of disturbance on birds.

While the Great Lakes can act as a barrier to the spread of terrestrial invasive species, they are a conduit for aquatic invasive non-native species. Zebra mussels (*Dreissena polymorpha*) and Round gobies (*Neogobius melanostromus*), small, bottom-dwelling invasive non-native fish have been found in all five Great Lakes and have begun to invade inland waters (Ontario Ministry of Natural Resources 2012). In Ontario, Zebra mussels and Round gobies are believed to be linked to outbreaks of Type E botulism in Great Lakes fish and at least 22 species of fish-eating birds (Canadian Cooperative Wildlife Health Centre 2007), and as such, have an overall medium-magnitude threat to priority species in this BCR (sub-category 8.1; Fig. 26). Recommended actions to mitigate the threat of invasive non-native species are similar to those proposed in other habitats and relate to prevention, control, management and monitoring their spread.

Type E botulism toxin is produced by a naturally occurring (native) bacterium (*Clostridium botulinum*) found in lake bottom sediment as harmless spores. However, under certain conditions – a rich nutrient source (such as a dead animal), a complete lack of oxygen, and an optimum temperature – the bacterium begins producing the toxin and the toxin enters the aquatic food chain. The toxin is believed to be passed from Zebra mussels, to Round gobies, to larger predators, resulting in large die-offs of fish and birds. Mussel-feeding diving ducks may acquire the toxin directly, rather than via a fish "vector." Scavengers such as gulls may acquire the toxin through consumption of toxin-containing carcasses, while shorebirds may do so through consumption of toxic invertebrates (Canadian Cooperative Wildlife Health Centre 2007). Outbreaks have occurred on Lake Ontario, Lake Erie, Lake Michigan and Lake Huron affecting fish-eating waterbirds at a significant level (Environment Canada 2013c). While more prevalent in the Lower Great Lakes, the threat of avian Type E botulism to priority species in BCR 12 ON has a medium overall magnitude (sub-category 8.2; Fig. 26) considering that in 2007, the range of the disease expanded to the Bruce Peninsula and Georgian Bay (Environment

Canada 2013c). Associated recommended research and monitoring actions are described in Table 23.

The emerging potential threat to waterbirds and waterfowl on the Great Lakes and other large waterbodies from the installation of offshore wind power turbines was also considered in BCR 12 ON. Experience at northern European offshore wind energy developments has shown a range of effects on birds including changes to movement or migration patterns, potentially increasing energetic costs, and displacement from important feeding areas (equal to habitat loss; Petersen 2006; Fox et al. 2006; Guillemette and Larsen 2002). Given the relatively recent emergence of this issue in Ontario, and the lack of information (sub-category 12.1) surrounding the delineation of key staging areas for waterfowl in particular, it was not possible to ascertain the scope and severity of this potential threat. However, recommended actions focus on research and monitoring (e.g., conducting periodic staging surveys in the Great Lakes to identify and monitor important staging areas) in Table 23.

The full list of threats to and information needs (sub-category 12.1) for priority species in waterbody habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 23.

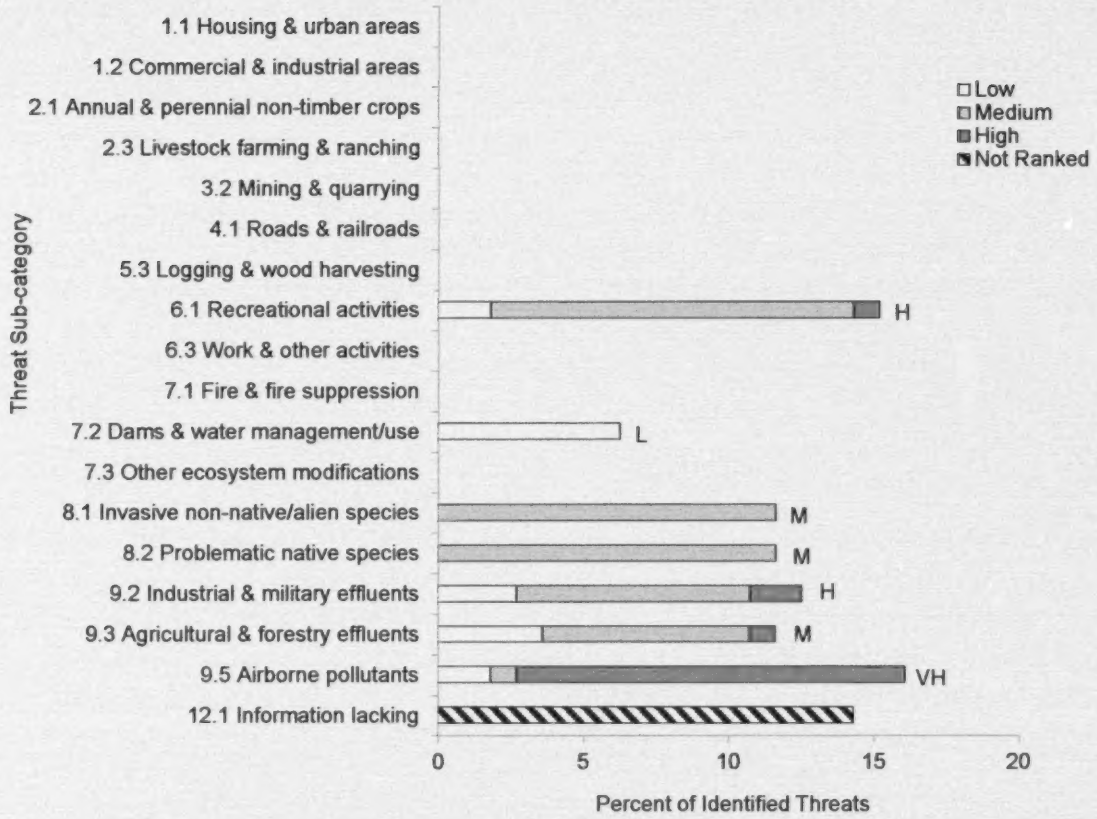

Figure 26. Percent of identified threats to priority species in waterbodies in each threat sub-category. Each bar represents the percent of the total number of threats identified in each threat sub-category in waterbodies (for example, if 100 threats were identified in total for all priority species in waterbodies, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category). The overall magnitude of the threat in waterbodies is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 23. Threats addressed, conservation objectives, recommended actions and list of priority species affected in waterbodies in BCR 12 ON.
Note: Issues such as collisions with human-made structures (threats sub-category 1.2 Commercial and industrial areas) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Disturbance to breeding, staging and/or foraging birds due to human recreation and human activity/access.	6.1 Recreational activities	Minimize human disturbance of priority species.	4.1 Reduce disturbance from human activity and recreation	Maintain a naturally-vegetated zone greater than or equal to 30 m around all lakes and rivers to protect the riparian zone from disturbance (Pearce 2011).	2.1 Site/area management	Bald Eagle,[2] Belted Kingfisher, Black Scoter, Bufflehead, Common Goldeneye, Common Merganser, Greater Scaup, Hooded Merganser, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Red-necked Grebe, Surf Scoter
				Raise awareness about the effects of human disturbance on priority bird species.	4.3 Awareness and communications	
				Limit recreational activities within the 30 m riparian zone around lakes and rivers (Pearce 2011).	5.2 Policies and regulations	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	American White Pelican, Bald Eagle, Horned Grebe (western population), Peregrine Falcon (*anatum/tundrius*)
Zebra mussels and round gobies linked to outbreaks of Type E botulism in Great Lakes fish-eating and mussel-eating birds.	8.1 Invasive non-native/alien species	Prevent and control the spread of invasive non-native species.	3.5 Prevent and control the spread of invasive and exotic species	Prevent the introduction and spread of invasive non-native species into aquatic ecosystems (e.g., via ballast water) and develop eradication protocols for coordinated management efforts.	2.2 Invasive/ problematic species control	Black Scoter, Bufflehead, Caspian Tern, Common Tern, Great Black-backed Gull, Greater Scaup, Herring Gull, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Red-necked Grebe, Surf Scoter
				Raise public awareness of the need to prevent the introduction and spread of invasive non-native species.	4.3 Awareness and communications	
				Develop and/or strengthen policies or regulatory measures geared to preventing the introduction and spread of invasive non-native species.	5.2 Policies and regulations	

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 23 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				Encourage participation in volunteer monitoring efforts (e.g., Invading Species Awareness Program) to help address threats from invasive non-native species to aquatic habitats.	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	American White Pelican, Horned Grebe (western population)
Type E botulism can be a major source of mortality and appear episodically in lakes where it is endemic.	8.2 Problematic native species	Monitor outbreaks.	7.4 Improve understanding of causes of population declines (mortality)	Identify the factors that cause outbreaks and evaluate various management procedures (e.g., early carcass removal) to minimize their effects.	8.1 Research	Black Scoter, Bufflehead, Caspian Tern, Common Tern, Great Black-backed Gull, Greater Scaup, Herring Gull, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Red-necked Grebe, Surf Scoter
				Monitor botulism outbreaks and determine the effect of outbreaks on bird populations (e.g., beached bird surveys).	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	American White Pelican, Horned Grebe (western population)
Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants.	9.2 Industrial & military effluents	Reduce exposure to environmental contaminants.	5.1 Maintain natural food webs and prey sources	Maintain a vegetated zone equal to or greater than 30 m wide around all lakes and rivers to minimize changes in water quality associated with adjacent land-uses (e.g., to reduce non-point source pollution; Pearce 2011).	2.3 Habitat and natural process restoration	Bald Eagle,[2] Black Scoter, Bufflehead, Common Merganser, Greater Scaup, Herring Gull, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Red-necked Grebe
				Identify and eliminate or reduce sources of persistent, bioaccumulative and toxic (PBTs) substances (e.g., mercury, polybromated diphenyl ether or PBDE) from entering	5.2 Policies and regulations	

Table 23 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				aquatic environments (Ontario Ministry of the Environment 2009). Encourage the inclusion of effective measures within environmental policies and regulations to prevent or mitigate oil spills, industry outfalls and other chemical spills.		
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Monitor and assess the effects of contaminants in birds.	7.1 Improve population/ demographic monitoring	Determine population-level effects of environmental contaminants on the vital rates of priority species.	8.1 Research	
				Monitor, assess and report on levels of environmental contaminants in priority species.	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Horned Grebe (western population), Bald Eagle, Peregrine Falcon (*anatum/tundrius*)
Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration caused by exposure to/ use of pesticides in forestry/ agricultural operations.	9.3 Agricultural & forestry effluents	Maintain/ improve water quality by reducing pesticide use.	5.1 Maintain natural food webs and prey sources	Maintain a vegetated zone equal to or greater than 30 m wide around all lakes and rivers to minimize changes to water quality associated with adjacent land-uses (e.g., to reduce non-point source pollution; Pearce 2011).	2.3 Habitat and natural process restoration	Bald Eagle,[2] Black Scoter, Bufflehead, Greater Scaup, Herring Gull, Lesser Scaup, Long-tailed Duck, Red-necked Grebe
				Identify and eliminate or reduce sources of persistent, bioaccumulative and toxic (PBTs) substances such as pesticides entering aquatic environments (Ontario Ministry of the Environment 2009).	5.2 Policies and regulations	
				Promote the use of IPM programs to reduce pesticide use.	5.3 Private sector standards and	

Table 23 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
					codes	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Monitor and assess the effects of contaminants in birds.	7.1 Improve population/ demographic monitoring	Determine population-level effects of environmental contaminants on the vital rates of priority species.	8.1 Research	
				Monitor, assess and report on levels of environmental contaminants in priority species.	8.2 Monitoring	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Bald Eagle, Peregrine Falcon (*anatum/tundrius*)
Acid precipitation affects the availability of prey items and reduces the quality of aquatic habitats.	9.5 Airborne pollutants	Reduce emissions of airborne pollutants.	1.5 Reduce habitat degradation from contaminants	Compliance promotion of existing air quality agreements.	5.4 Compliance and enforcement	Bald Eagle,[2] Belted Kingfisher, Black Scoter, Bufflehead, Caspian Tern, Common Merganser, Common Tern, Great Black-backed Gull, Greater Scaup, Herring Gull, Hooded Merganser, Horned Grebe (western population),[2] Lesser Scaup, Long-tailed Duck, Red-necked Grebe
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	American White Pelican, Bald Eagle, Horned Grebe (western population)
Lack of knowledge – effects of	12.1 Information lacking	Improve understanding of the effects of	7.1 Improve population/ demographic	Determine effects of offshore wind farms and the displacement of birds from staging habitat.	8.1 Research	Black Scoter, Bufflehead, Common Goldeneye, Common Merganser, Greater

Table 23 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
offshore wind power operations on staging waterfowl.		offshore wind turbines on staging waterfowl.	monitoring			Scaup, Lesser Scaup, Long-tailed Duck, Surf Scoter, White-winged Scoter
Lack of knowledge (trend, population size, and/or distribution range).		Assess offshore population distribution and abundance.		Conduct periodic offshore surveys to determine the distribution and abundance of waterfowl during staging and wintering periods.	8.2 Monitoring	
		Improve monitoring efforts to increase reliability of population status/trend.		Evaluate alternative strategies for filling gaps in coverage for marsh birds and colonial waterbirds.	8.2 Monitoring	Caspian Tern, Common Tern, Great Black-backed Gull, Herring Gull, Horned Grebe (western population),[2] Red-necked Grebe
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Horned Grebe (western population)[2]
Lack of knowledge of underlying cause(s) of population decline.		Determine cause(s) of population decline.	7.4 Improve understanding of causes of population declines	Investigate the potential causes of population decline, including effects of water quality and food availability at a variety of nesting sites (Ontario Partners in Flight 2008).	8.1 Research	Belted Kingfisher

Riparian

Riparian areas occur adjacent to standing or flowing water where the vegetation is influenced by the presence of water and is distinct from adjacent uplands. Riparian areas may be forested, shrubby or bare, depending on site conditions. While there are no available provincial land cover estimates of the total area of riparian habitats in BCR 12 ON, they have been defined here as habitats within 30 m of water, and a map depicting the extent of derived riparian areas has been developed for illustrative purposes (Fig. 27). The depiction of riparian areas below is therefore an overestimate of the actual land area occupied by this habitat type.

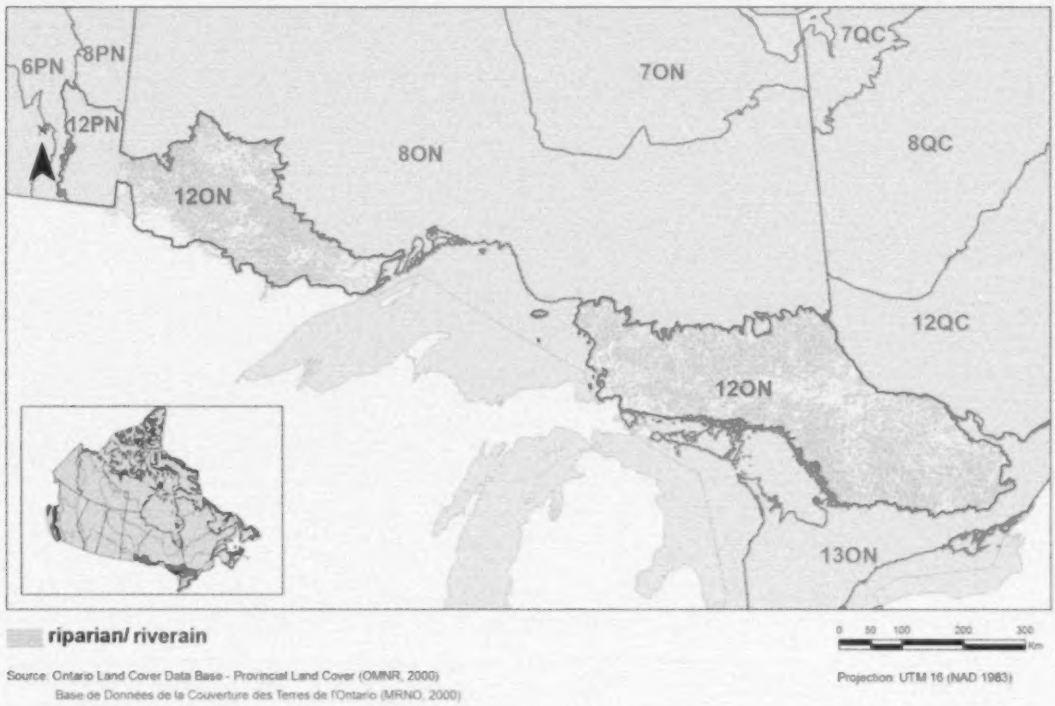

Figure 27. Map of riparian habitats in BCR 12 ON.

Riparian habitats are used extensively by 12 priority species (Table 24). These species use the terrestrial habitats for breeding, and also forage in or around the aquatic habitats. Consequently, threats to priority species in riparian habitats share elements with other terrestrial and aquatic habitats.

Table 24. Priority species associated with riparian habitats in BCR 12 ON, habitat description, population objectives and reasons for priority status.

Priority Species	Habitat Description[1]	Population Objective	COSEWIC[2]	SARA[3]	SARO[4]	Regional/Subregional Concern[5]	Regional/Subregional Stewardship[6]	National/Continental Concern	National/Continental Stewardship
Bald Eagle	Riparian mixed (evergreen) trees	Recovery objective[†]			Y	Y			Y
Bank Swallow	Riparian slopes, banks and bluffs	Increase	Y			Y			
Belted Kingfisher	Riparian bare area; rivers; banks and bluffs	Increase					Y		
Black-crowned Night-Heron	Rivers	Assess/Maintain				Y			
Bufflehead	Riparian mixed forest	Maintain current				Y			
Common Goldeneye	Riparian mixed forest	Maintain current				Y		Y	
Common Merganser	Riparian mixed forest	Maintain current				Y			
Hooded Merganser	Riparian mixed forest	Maintain current				Y			
Louisiana Waterthrush	Riparian mixed deciduous forest	Recovery objective	Y	Y	Y	Y		Y	Y
Rusty Blackbird	Riparian mixed forests	Recovery objective[†]	Y	Y		Y		Y	
Spotted Sandpiper	Riparian grasslands, river banks	Maintain current				Y		Y	
Wood Duck	Forested riparian areas	Maintain current				Y			

Threats related to habitat loss from urban development (threat sub-category 1.1) as well as habitat alteration by forestry (sub-category 5.3) were each determined to have a medium

[1] Habitat descriptions are based on information found in the Atlas of the Breeding Birds of Ontario, 2001-2005 and, in most cases, follow definitions under the LCCS (see Kennedy et al. 2012).
[2] Assessed by COSEWIC as Endangered, Threatened or Special Concern.
[3] Species listed on Schedule 1 of SARA as Endangered, Threatened or Special Concern.
[4] Species listed as Endangered, Threatened or Special Concern on the SARO List.
[5] Regional refers to BCR-wide (i.e. all jurisdictional data were used for the entire BCR) while Subregional refers to the Ontario portion of the BCR only (i.e. Ontario BCR data were used).
[6] Only the landbird group distinguishes stewardship species from other priority species (see Panjabi et al. 2005).
[†] Species listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, the interim population objectives for these species in BCR 12 ON are: Bald Eagle: Assess/Maintain; Rusty Blackbird: Increase.

magnitude overall. Protection of sensitive riparian habitats through land use planning, the provision of buffers around watercourses and the retention of important bird features such as cavity nesting trees, were identified as important conservation actions to protect riparian birds (Table 25).

Habitat loss, degradation and disturbance by construction and maintenance of transportation networks in BCR 12 ON was assessed as a medium overall threat to priority species in riparian habitats (sub-category 4.1). The effects of roads on wildlife depend on their location, density of road corridors and their level of use. In BCR 12 ON, road densities are highest in the south-eastern portion and in the vicinity of urban centres (Ontario Biodiversity Council 2010). The construction of new and maintenance of both forest access roads and roads between and within urban centres can have both direct and indirect effects on birds and other wildlife, including mortality from collisions with vehicles, individual species disruption attributed to noise and dust, habitat loss, fragmentation and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from increased predator/prey contact, and increased exposure to invasive species. Recommended riparian habitat conservation actions seek to mitigate the effects of roads through the implementation of BMPs or mitigation guidelines to avoid habitat loss and degradation (Table 25). The Widespread Issues section of this strategy addresses the issue of collisions with vehicles in more detail.

Human disturbance (sub-category 6.3), related primarily to resource extraction activities across the BCR, was also identified as an important threat to priority birds in riparian habitats (Fig. 28). Maintaining naturally vegetated buffer zones around riparian habitats, as well as increasing awareness of the adverse effects of disturbance, could be beneficial for priority species that are particularly sensitive to disturbance, or for those that nest in colonies, such as Bank Swallows or Black-crowned Night-Herons.

Some persistent, bioaccumulative and toxic substances, including polychlorinated biphenyls (PCBs), pesticides and polybrominated diphenyl ethers (PBDEs), can be carried long distances from their sources through the air in a process known as long-range transport. This results in some contamination in even the most remote lakes and streams in Ontario (Ontario Ministry of the Environment 2012). Degradation of aquatic habitats due to direct inputs of pollutants from forestry and industry (threat sub-categories 9.3 and 9.2 respectively) poses a significant threat to priority birds in some portions of the region where these activities occur. Conservation actions focus on improving riparian habitat quality through maintaining naturally vegetated riparian areas, working with industry and policy-makers to reduce the quantity of toxic chemicals released into the environment as well as monitoring and enforcing compliance with laws, policies and regulations at all levels (Table 25).

The full list of threats to and information needs (sub-category 12.1) for priority species in riparian habitats of BCR 12 ON as well as the objectives and recommended conservation actions are presented in Table 25.

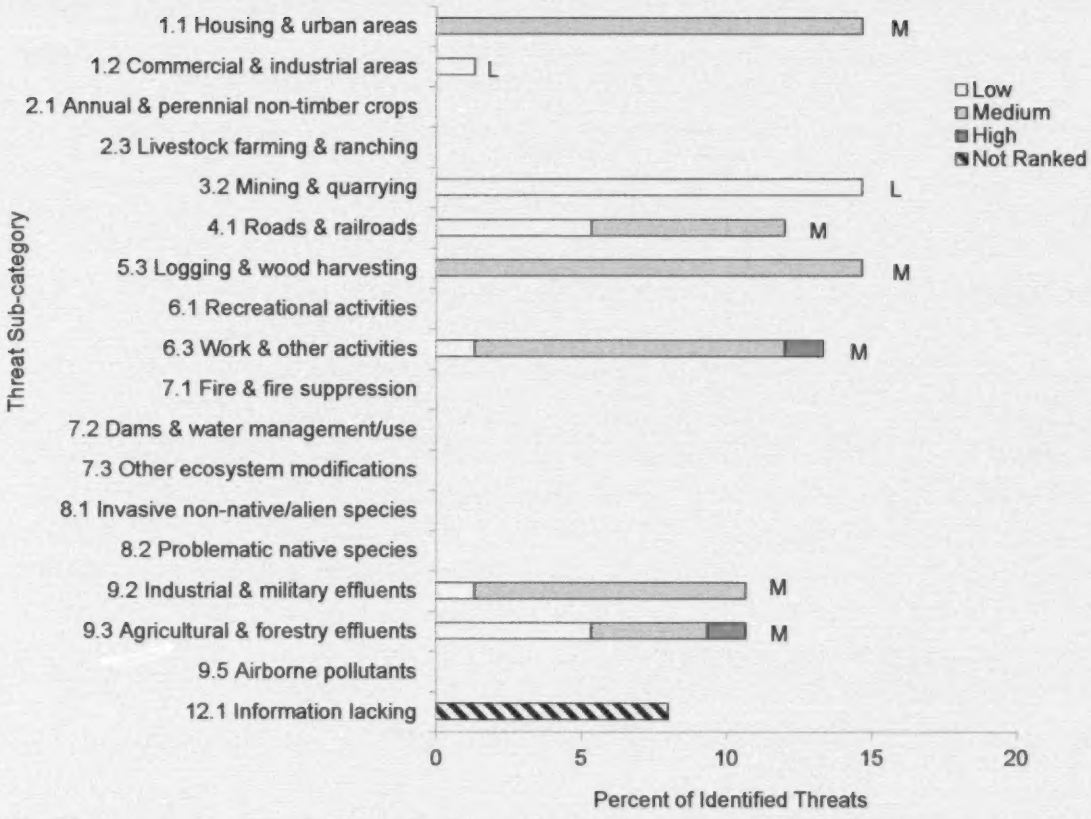

Figure 28. Percent of identified threats to priority species in riparian habitats in each threat sub-category.

Each bar represents the percent of the total number of threats identified in each threat sub-category in riparian habitat (for example, if 100 threats were identified in total for all priority species in riparian habitat, and 10 of those threats were in the category 1.1 Housing & urban areas, the bar on the graph would represent this as 10%). Threat sub-category 12.1 Information lacking was not ranked. The bars are divided to show the distribution of Low (L), Medium (M) and High (H) rankings of individual threats within each threat sub-category. For example, the same threat may have been ranked H for one species and L for another; the shading illustrates the proportion of L, M and H rankings in the sub-category. The overall magnitude of the threat in riparian habitats is shown at the end of each bar (also presented in Table 5). Only threats with a magnitude of medium or higher are typically assigned habitat-specific conservation objectives.

Table 25. Threats addressed, conservation objectives, recommended actions and list of priority species affected in riparian habitats in BCR 12 ON.
Note: Issues such as collisions with human-made structures and vehicles (threats sub-category 1.2 Commercial and industrial areas and 4.1 roads and railroads) and climate change are not addressed in this table; instead they are addressed in the Widespread Issues section.

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Loss and/or degradation of habitat due to urban development.	1.1 Housing & urban areas	Maintain, enhance or restore quantity, quality and diversity of riparian habitats across the landscape.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Encourage land use planning and zoning that eliminates housing/cottage development in sensitive riparian areas.	1.1 Site/area protection	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Bufflehead, Common Goldeneye, Common Merganser, Hooded Merganser, Rusty Blackbird,[2] Spotted Sandpiper, Wood Duck
				> 75 % of stream length or lake perimeter should be naturally vegetated (Pearce 2011).	1.2 Resource and habitat protection	
				Ensure presence of important bird features (e.g., cavity nesting trees, natural vegetation cover, earthen banks) as appropriate to the priority species (e.g., Common Merganser, Wood Duck, Bank Swallow). Avoid stabilizing banks containing bank swallow nest or banks that may be suitable nesting habitat for Bank Swallow or Belted Kingfisher.	2.1 Site/area management	
				Maintain a > 30 m naturally vegetated zone around all lakes, ponds, rivers, and streams to stabilize banks and minimize changes to water quality associated with adjacent land-uses (Pearce 2011).	2.3 Habitat and natural process restoration	
				Include guidelines for the protection of riparian-nesting species in BMPs for municipal planning.	5.2 Policies and regulations	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Bald Eagle, Rusty Blackbird

[1] While many priority species may benefit from proposed conservation actions, priority species not mentioned in this table are absent because 1) identified threats in this habitat are of low magnitude or 2) they are migrants with no threats identified in this habitat.
[2] Species is listed on Schedule 1 of SARA and/or on the SARO List, but for which there are no finalized recovery documents. Official documents related to SARA or SARO will prevail when they are published; however, interim conservation objectives and recommended actions are presented here.

Table 25 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
Habitat loss/degradation and disturbance by construction and maintenance of transportation networks.	4.1 Roads & railroads	Reduce/eliminate habitat loss, fragmentation and/or degradation from the construction and maintenance of road networks and associated infrastructure.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	Develop and/or implement existing BMPs or mitigation guidelines to avoid habitat loss, fragmentation and/or degradation from road construction and maintenance of road networks.	5.2 Policies and regulations 5.3 Private sector standards and codes	Black-crowned Night-Heron, Common Goldeneye, Common Merganser, Bufflehead, Wood Duck
Modification of shoreline or riparian nesting habitat or nest trees due to logging.	5.3 Logging & wood harvesting	Maintain riparian habitat composition, pattern and structure within the ERNV.	1.1 Ensure land and resource-use policies and practices maintain or improve bird habitat	> 75 % of stream length or lake perimeter should be naturally vegetated (Pearce 2011).	1.2 Resource and habitat protection	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night Heron, Bufflehead, Common Goldeneye, Common Merganser, Hooded Merganser, Rusty Blackbird,[2] Wood Duck
				Ensure presence of important bird features (e.g., cavity nesting trees, natural vegetation cover, earthen banks) as appropriate to the priority species (e.g., Common Merganser, Wood Duck, Bank Swallow). Avoid stabilizing banks containing bank swallow nest or banks that may be suitable nesting habitat for Bank Swallow or Belted Kingfisher.	2.1 Site/area management	
				Maintain a > 30 m naturally vegetated zone around all lakes, ponds, rivers, and streams to stabilize banks and minimize changes to water quality associated with adjacent land-uses (Pearce 2011).	2.3 Habitat and natural process restoration	
				Include guidelines for the protection of riparian-nesting species in BMPs in forest management planning.	5.2 Policies and regulations	
				Ensure that linkages are developed and maintained between bird conservation and forest management planning policies.	7.2 Alliance and partnership development	
		Meet the legal requirements for a federal/provincial	3.4 Implement recovery strategies for	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Bald Eagle, Louisiana Waterthrush, Rusty Blackbird

Table 25 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		Species at Risk legislation.	species at risk			
Disturbance to breeding, staging and/or foraging birds due to human activity/access (resource extraction).	6.3 Work & other activities	Minimize human disturbance of priority species in riparian habitats.	4.2 Reduce disturbance from industrial or work activity	Maintain a > 30 m naturally vegetated zone around all lakes, ponds, rivers and streams to stabilize banks, minimize changes to water quality associated with adjacent land-uses and to protect the riparian zone from disturbance (Pearce 2011). Greater than 75 % of the stream length or lake perimeter should be naturally vegetated (as a buffer) and where possible, with vegetation composition and age-class structure within the normal range of variation that could be found in that landscape (Pearce 2011).	2.3 Habitat and natural process restoration	Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Bufflehead, Common Goldeneye, Common Merganser, Hooded Merganser, Spotted Sandpiper, Wood Duck
				Raise awareness about the effects of human disturbance on priority bird species.	4.3 Awareness and communications	
				Include guidelines for the protection of riparian bank-nesting species in Forest Management and Official Municipal Plans (Bank Swallow, Belted Kingfisher; Ontario Partners in Flight 2008).	5.2 Policies and regulations	
Mortality, sub-lethal effects and/or habitat degradation from heavy metals and other environmental contaminants.	9.2 Industrial & military effluents	Maintain/improve riparian habitat quality.	1.5 Reduce habitat degradation from contaminants	Both sides of streams should have a minimum 30-metre wide naturally vegetated riparian area to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres, and 75 % of stream length should be naturally vegetated (Environment Canada, 2013b).	2.3 Habitat and natural process restoration	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron, Bufflehead, Common Goldeneye, Common Merganser, Wood Duck

Table 25 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
				Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	4.3 Awareness and communications	
				Work with industry and policy-makers to reduce the quantity of toxic chemicals released into the environment. Encourage the inclusion of effective protection and emergency response measures within environmental policies and regulations to prevent or mitigate oil spills, industrial outfalls and other chemical spills.	5.2 Policies and regulations	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Bald Eagle
Mortality, sub-lethal effects, reductions in prey populations, and habitat alteration caused by exposure to or use of pesticides.	9.3 Agricultural & forestry effluents	Maintain/improve riparian habitat quality by reducing pesticide use.	5.1 Maintain natural food webs and prey sources	Undertake education and awareness activities regarding the impact of environmental contaminants on birds and their habitats.	4.3 Awareness and communications	Bald Eagle,[2] Bank Swallow, Belted Kingfisher, Black-crowned Night-Heron
				Work with industry and policy-makers to reduce the quantity of toxic chemicals released into the environment.	5.2 Policies and regulations	
				Develop or implement existing BMPs to reduce potential risks to birds and their habitats from pesticide use. Promote the use of IPM programs to reduce pesticide use.	5.3 Private sector standards and codes	
				Continue to monitor and enforce compliance with laws, policies and regulations at all levels.	5.4 Compliance and enforcement	

Table 25 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Bald Eagle
Lack of information on factors causing population declines.	12.1 Information lacking	Determine sources of mortality or population decline(s).	7.4 Improve understanding of causes of population declines	Identify factors causing population decline and/or limiting population growth of aerial-foraging insectivores.	8.1 Research	Bank Swallow
				Identify factors causing population decline and/or limiting population growth including assessing the effects of water quality and food availability on population demographics at a variety of nesting sites (Ontario Partners in Flight, 2008).		Belted Kingfisher
		Improve population/demographic monitoring of aerial insectivores.	7.1 Improve population/ demographic monitoring	Encourage volunteer participation in Project NestWatch to increase data on nesting activity and to improve understanding of changes in productivity.	8.2 Monitoring	Bank Swallow
		Determine sources of mortality or population decline(s).	7.4 Improve understanding of causes of population declines	Investigate potential causes of population decline; improve understanding of breeding and wintering ecology. (Ontario Partners in Flight 2008).	8.1 Research	Rusty Blackbird[2]
				Implement research and monitoring priorities described within the *Ontario Shorebird Conservation Plan* (Ross et al. 2003).		Spotted Sandpiper
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Rusty Blackbird
Lack of knowledge (trend, population size,		Improve monitoring efforts to increase reliability of population status/trend.	7.1 Improve population/demographic monitoring	Improve monitoring efforts to increase reliability of population status/trend for species (poor accessibility to breeding grounds– Rusty Blackbird, colonial nesters –	8.2 Monitoring	Bank Swallow, Rusty Blackbird[2]

Table 25 continued

Threats Addressed	Threat Sub-category	Objectives	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected[1]
and/or distribution range).				Bank Swallow).		
		Meet the legal requirements for a federal/provincial Species at Risk legislation.	3.4 Implement recovery strategies for species at risk	Develop and/or implement species at risk recovery strategies or management plans.	3.2 Species recovery	Rusty Blackbird

Section 3: Additional Issues

Widespread Issues

Some well-known conservation issues may not be identified in the literature as significant threats to populations of an individual priority species and therefore may not be captured in the threat assessment. However, these issues, while they may or may not be limiting factors for any individual species or population, contribute to avian mortality or decreases in fecundity across many species and thus warrant conservation attention. Usually these issues transcend habitat types and are considered "widespread." Examples of these issues include:

- Collisions with human-made structures (buildings, vehicles, utility/telecommunications towers and lines)
- Predation by domestic cats
- Pollution/pesticides/oil spills
- Climate change

Because the widespread issues do not fit into the standard presentation format used in the BCR strategies, they are presented separately here. The mortality estimates included here are largely based on draft reports that were available within Environment Canada when this strategy was produced; the numbers may change as the final scientific papers are peer-reviewed and published. Human-related avian mortality across all sectors was standardized and compared in Calvert et al. (2013).

Collisions

The networks of roads, transmission lines, communications towers and human settlements are extensive in BCR 12 ON by Canadian standards, but much less so than in BCR 13 to the south. Still, birds in some portions of this region are exposed to a substantial risk of collisions with buildings, vehicles, communications towers and an increasing number of wind turbines.

Buildings

Collisions with glass windows or reflective panels on buildings are believed to be a significant source of bird mortality in Canada. Estimates of mortality from collisions with houses in Canada (including birds using feeders) range from approximately 15.8–30.5 million birds per year (Machtans et al. 2013). Mortality from collisions with buildings of less than 12 storeys is estimated at approximately 0.3–11.4 million birds/year, and for all cities in Canada with tall buildings in an urban core, the estimate is 13 000 – 256 000 birds/year. The total estimate of mortality from collisions with buildings in Canada is therefore between 16.1–42.2 million birds/year (Machtans et al. 2013).

Data from Canada and the northeastern United States reveal that 163 species of birds of 32 families are known to have been killed by buildings. Some families and species of birds are disproportionately affected by collisions with buildings. *Parulidae* (warblers), *Fringillidae* (sparrows and allies) and *Regulidae* (kinglets) account for 70% of all bird deaths; the species most frequently killed are White-throated Sparrows (13.5% of all reported deaths),

Golden-crowned Kinglets (10.2%), Dark-eyed Juncos (6.1%), Ovenbirds (5.3%) and Ruby-crowned Kinglets (5.3%). The population-level effects of bird mortality from building strikes are unknown. Collisions with buildings were identified as a potential threat to a large number of priority landbirds, but the full extent of this source of mortality in this BCR is poorly understood. See Table 26 for conservation objectives and actions.

Wind Turbines

The 2 955 wind turbines in Canada in 2011 have drawn considerable attention for their potential to cause mortality to birds and other species (notably bats). Two sources of mortality are typically associated with wind turbines: collisions with the turbines themselves, and the destruction of nests by turbine construction activities during the breeding season. On average, 5.9 birds are killed per turbine per year. Scaling up to a national level, an estimated 16 700 birds (range 13 300 – 21,600) die from collisions with wind turbines each year (Table 26; Zimmerling et al., 2013).

Some species are particularly vulnerable to collisions with wind turbines, for example, raptors flying along a land/water interface. For smaller, more common passerine species (warblers, thrushes, kinglets, etc.), the relatively small number of birds affected does not appear to pose a population-level threat. However, the anticipated proliferation of wind turbines means that we should continue to ensure that turbines are sited to avoid important bird habitats and migration corridors.

In addition to collision mortality, wind turbines construction and installation can result in the loss of habitat for birds. At the 43 terrestrial wind farms in Canada for which data are available, on average, total habitat loss per turbine is approximately 1.23 ha on average. Based on this average, the predicted total habitat loss for wind farms nationwide is 3 635 ha. Using published estimates of nest densities, the total number of affected nests, not accounting for construction that might occur outside the breeding season, is approximately 5,700 (Zimmerling et al. 2013). See Table 26 for conservation objectives and actions.

Communication Towers

There are currently almost 8 000 communication towers in Canada greater than 60m high (Longcore et al. 2012), each of which can pose a hazard to birds during migration. Birds are attracted to the lights of communication towers and are killed when they collide with the structures and guy wires. Mortality increases exponentially with tower height, in part because the use of guy wires also increases with tower height. Poor weather also plays a significant role in increasing migrant fatality; foggy and cloudy conditions increase the lit area around towers and block celestial clues used by migrating birds. The result is that birds circle to exhaustion in the halo of artificial light, or collide with each other, the tower or its guy wires (American Bird Conservancy 2012).

Avian mortality at towers is unequally distributed among species and regions, but estimates suggest that over 220 000 birds are killed in Canada each year (Longcore et al. 2012).

Neotropical migrants in the families *Parulidae* (wood-warblers) and *Vireonidae* (vireos) are the species most commonly killed by communication towers. These families include threatened species, and many that are of conservation concern in Canada and/or the United States. When considered in concert with mortality at towers in the United States (which is 20 times higher due to the larger number and greater height of towers in the United States), and the mortality from other stationary structures, mortality from collisions with communications towers may negatively affect the population trends of some birds. See Table 26 for conservation objectives and actions.

Power Lines

Birds may be killed by colliding with power lines, or they may be electrocuted. Species with high wing-loading and thus low maneuverability, such as waterfowl, appear particularly at risk for collisions (Bevanger 1998). Electrocutions are most likely for large birds such as raptors and herons, whose bodies are large enough to span the distances between wires and create a short circuit. Raptors' habit of using power poles as perches further increases their risk. However, estimates of total mortality due to collisions and electrocutions can vary widely (Manville, 2005) and population-level impacts are difficult to determine. Canadian estimates are that 161 000 – 802 000 birds are killed annually by electrocution and another 5.3–20.6 million birds are killed each year by colliding with electrical transmission lines (Calvert et al. 2013). See Table 26 for conservation objectives and actions.

Vehicles

There are over 1.4 million km of roads and hundreds of airports in Canada (World Bank Indicators 2012) which are often bordered by fences and vegetation that provide convenient places for birds to perch, forage and nest. The paved surfaces can attract birds through the heat they emit, the puddles that form beside roads, and the salt and grit used for de-icing. Current estimates for one- and two-lane paved roads outside major urban centres in Canada are that between 4.65 and 13.8 million birds are killed annually (Bishop and Brogan 2013).

Bird collisions with cars are influenced by the location of the road, proximity of vegetation and vehicle speed. Raptors and owls that hunt and forage near roads are particularly vulnerable, but many species that forage for grit and road salt or are otherwise attracted to roads have a high likelihood of being hit by vehicles. The population level effects of this source of mortality are not known. See Table 26 for conservation objectives and actions.

Collisions with vehicles can result in significant mortality of priority species that forage on or near roadsides, and in BCR 12 ON, specific concern exists for the Short-eared Owl (COSEWIC-assessed and SARA-listed species of Special Concern), the Common Nighthawk (assessed by COSEWIC and listed on SARA as Threatened; provincial species of Special Concern) and Great Gray Owl.

Roads have both direct and indirect effects on birds and other wildlife, including mortality from vehicle strikes, disruption attributed to noise and dust, habitat loss and degradation (loss of suitable nest sites, destruction of nest sites, decline of prey species), indirect mortality from

increased predator/prey contact, and increased exposure to invasive species. Environmental effects include accelerating erosion from road surfaces, alteration of surface water flows and the timing of peak flows, erosion during flood events, increased landslides, and loss of soil productivity. For aquatic habitats, roads may introduce barriers to fish migration, cause changes in water temperature and alter stream flow regimes (Global Forest Watch 2000).

Several approaches can be used to mitigate the effects of expanding road networks. Restricting or limiting road access in key areas during critical times of year (e.g., breeding) can reduce disturbances during the most important periods. Access management outside hunting seasons will likely be met with less public opposition and may be easier to implement (Gratson and Whitman 2000), although attempts should be made to restrict road access during seasons associated with specific life requisites such as courtship/mating, breeding/nesting, brood-rearing, staging and migration. New road networks should be designed in conjunction with other land-use activities (Integrated Landscape Management approaches) to maximize coordination and emulate or simulate the region's natural disturbance regime (Miller et al. 1996). Finally, decommissioning of roads that are no longer required can restore habitat and prevent erosion. Road removal techniques include road ripping (decompacting road surface, addition of soil, and re-vegetation), which decreases soil compaction; restoration of stream crossings, which also allows for natural water flows across roads; and full re-contours, which re-grade the land around the road and completely remove any trace of the road (Switalski et al. 2004).

Predation by Domestic Cats

Based on the number of pet cats in Canada and published kill rates by cats elsewhere, roughly 204 million birds (range 105–348 million) are killed by domestic and feral cats in Canada each year (Blancher 2013). The broad range on this estimate reflects imprecise information on the average number of bird kills per cat, especially for rural and feral cats, and a lack of information on the number of feral cats (versus owned or pet cats) in Canada.

The birds most susceptible to cat predation are those that nest or forage on or near the ground or spend substantial time in human-dominated landscapes (both rural and urban) where cats are abundant. The proportion of Canada's birds killed by cats is higher if additional cat predation when migrating through, or wintering in, the U.S. is factored in.

Without detailed study of the individual species affected, it is difficult to assess whether mortality caused by cat predation impacts population trends of birds in Canada. Nevertheless, it is likely that many species of birds are potentially vulnerable to population effects at the local scale in southern Canada. Because the human (and hence cat) population in BCR 12 ON is relatively low, it is unlikely that cat predation has significant effects on priority bird populations for the region as a whole. Nonetheless, actions to educate the public about the easily avoided mortality of birds from domestic cats and to better understand whether individual species are significantly affected would be of benefit (Table 26).

Pollution

Pollution caused by industrial chemicals, pesticides, and heavy metals can have both direct and indirect effects on survival and reproduction in birds. Sometimes the effects of exposure to pollutants are unexpected and do not result in immediate, measurable effects on bird populations (Eeva and Lehikoinen 2000; Franceschini et al. 2008; North American Bird Conservation Initiative, U.S. Committee 2009; Mineau 2010). However, persistent exposure can result in sharp declines in bird populations, as happened with Peregrine Falcons in eastern Canada prior to the ban of the chemical DDT. See Table 26 for conservation objectives and actions.

Pesticides

The most recent estimate suggests that 0.96–4.4 million birds are killed by pesticides annually in Canada (Mineau 2010). Provinces such as Saskatchewan, which have a large agricultural land base, account for the majority of the estimated kill, and pesticides are thought to be an important contributor to the decline in grassland bird species in Canada (Mineau 2010). Pesticides can kill birds rapidly following contact or may have sub-lethal effects such as suppressed immune function and reduced stress response. There may also be indirect effects of pesticides such as reduction in prey and changes in vegetation that reduce habitat quality. While the use of many toxic pesticides has been eliminated in Canada, migratory birds are still exposed while on wintering grounds in countries where their use is still permitted (Mineau 2010). See Table 26 for conservation objectives and actions.

The release of agricultural pesticides has a limited scope in BCR 12 ON owing to the comparatively small area under intensive agricultural production. Release of pesticides (herbicides) and other pollutants from forestry activities was determined to be a larger issue, and was assessed as a threat of high magnitude overall to priority birds in the region (Fig. 6). The continued introduction of alien invasive species has increased the diversity of forest pests requiring management, and increased frequency or severity of outbreaks of existing pests is a predicted consequence of climate change (Colombo 2008). Both factors mean that use of pesticides in forested habitats could increase in the future.

Toxic Chemicals and Heavy Metals

Toxic organic chemicals and heavy metals released into the environment can also negatively affect bird populations. While some industrial chemicals such as PCBs are regulated, there is concern about new chemicals such as flame retardants (PBDE) that are used in computers, car parts, and upholstery and whose effects on wildlife are largely unknown (Environment Canada 2003). Scavengers experience toxic effects when they ingest lead shotgun pellets or bullet fragments embedded in carcasses of game animals, and loons and other waterbirds are exposed to lead from shotgun pellets, sinkers and jigs that they ingest either while collecting grit for their gizzards or by eating bait fish with line and sinker still attached (Scheuhammer and Norris 1996; Scheuhammer et al. 2003). In some areas, lead poisoning from sinkers and jigs can account for approximately half of the mortality of adult Common Loons on their breeding grounds (Scheuhammer and Norris, 1996). Birds are also susceptible to bioaccumulation of

other toxic metals such as methylmercury, selenium and others when they consume prey that has been exposed to these substances.

Release of industrial chemicals was considered to have an overall threat of medium magnitude across all priority species and habitats (Fig. 6) in BCR 12 ON, similar to that for agricultural and forestry-related contaminants. In recent decades, significant progress has been made at reducing the exposure of waterbirds in the Great Lakes to contaminants (e.g., Pekarik and Weseloh 1998). Challenges still remain, and the effects on bird populations or food webs for many of the "new" persistent organic pollutants remain poorly understood. See Table 26 for conservation objectives and actions.

Oil Pollution

Oil may enter the environment either accidentally, through deliberate dumping, or in contained tailings ponds. It may be a single large event, as occurred in the Gulf of Mexico in 2010, or numerous smaller events. Annual estimates are that between 217 800 and 458 600 birds are killed by ship-source oil spills annually (Calvert et al. 2013). Typically, diving birds are most at risk of oiling; however, any birds that come into contact with oil are vulnerable. Oil can impact birds through direct effects such as hypothermia (resulting from lost waterproofing of feathers following oil contamination), toxicity (from ingesting oil as they preen or by inhaling volatile organic compounds) and indirect effects, such as reduced prey availability and decreased quality of habitat. While techniques exist to clean and rehabilitate oiled birds, many birds die before, during and after rescue attempts (Brown and Lock 2003).

The shipping trade in the Great Lakes St. Lawrence Seaway system is dominated by mining and agricultural products (80%), with fuel oil and petroleum products accounting for less than 10% of trade (Seaway Corporation, 2012). The risk of catastrophic, accidental spills is small, and oil pollution was not identified as a significant population-level threat to any priority species in BCR 12 ON. However, the potential exists for increasing shipments of petroleum products in the future and associated adverse effects of chronic oil discharge. Ongoing enforcement and monitoring of chronic oil discharge are necessary for the protection of birds of the Great Lakes. See Table 26 for conservation objectives and actions.

Table 26. General conservation objectives and actions associated with bird mortality from collisions and pollution in BCR 12 ON.

Threats addressed	Threat Sub-category	Objective	Objective category	Recommended Actions	Action Sub-category	Example Priority Species Affected
Collision mortality						
Collisions with buildings cause bird mortality.	1.1 Housing and urban areas 1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with windows/ buildings.	2.7 Reduce incidental mortality from collisions	Follow BMPs for bird-friendly buildings including using bird-friendly glass, reducing reflection from windows, providing visual markers to enable birds to perceive windows, and reducing light pollution.	2.1 Site/area management 5.3 Private sector standards and codes	All species
Collisions with wind turbines cause bird mortality.	3.3 Renewable energy	Reduce incidental mortality from collisions with wind turbines.	2.7 Reduce incidental mortality from collisions	Follow BMPs for reducing bird mortality when designing and locating wind turbines. Ensure that offshore wind energy developments will not present significant migration barriers. Locate offshore wind energy developments away from seabird breeding colonies and important waterbird foraging areas. Use techniques such as radar monitoring to determine pre-construction flight paths and assess the degree to which wind farms present migration barriers; and infrared camera systems to quantify strike rates.	2.1 Site/area management 5.3 Private sector standards and codes 1.2 Resource and habitat protection 8.2 Monitoring	All species
Collisions with communication towers cause bird mortality, particularly during migration.	1.2 Commercial and industrial areas	Reduce incidental mortality from collisions with human-made structures.	2.7 Reduce incidental mortality from collisions	Follow BMPs for reducing mortality to birds when constructing new communications towers. Switch off solid lights on existing towers and ensure that remaining lights have a synchronized, complete dark phase. Take steps to ensure that new towers avoid guy wires and minimize height, and avoid topographic locations where migrating birds are likely to be found in abundance. Retrofit existing towers to adhere to as many	2.1 Site/area management 5.3 Private sector standards and codes	All species

Table 26 continued

Threats addressed	Threat Sub-category	Objective	Objective category	Recommended Actions	Action Sub-category	Example Priority Species Affected
				guidelines as possible.		
Collisions with power lines and accidental electrocution cause bird mortality.	4.2 Utility and service lines	Reduce mortality from collisions with utility lines/ transmission towers.	2.7 Reduce incidental mortality from collisions	In high-risk areas, retrofit power lines so that the risk of electrocution of raptors is minimized. In new developments, locate transmission lines underground. Use markers or paint to increase visibility of power lines in high-strike areas. Avoid siting lines over or near wetlands.	2.1 Site/area management	Peregrine Falcon (*anatum/tundrius*) , Bald Eagle
Collisions with vehicles cause bird mortality.	4.1 Roads and railroads	Reduce mortality from collisions with vehicles.	2.7 Reduce incidental mortality from collisions	Erect road signs or speed bumps to lower vehicle speeds where bird activity is frequent. Remove plants that attract birds from roadsides and medians. Landscape along roads using taller trees and bushes to cause birds to fly higher. Encourage the use of salt management plans to avoid unnecessary use of particulate salt (a bird attractant) on roads. Avoid locating roads in valuable bird habitat.	2.1 Site/area management 1.1 Site/area protection	American Kestrel, Bald Eagle, Barn Swallow, Common Nighthawk, Killdeer, Red Crossbill, Short-eared Owl
Population effects of collisions are unknown.	12.1 Information lacking	Improve understanding of population effects of mortality from collisions.	7.4 Improve understanding of causes of population declines	Assess the biological importance of bird kills from all sources of collisions.	8.1 Research	All species

Table 26 continued

Threats addressed	Threat Sub-category	Objective	Objective category	Recommended Actions	Action Sub-category	Example Priority Species Affected
Environmental Contaminants						
Mortality, sub-lethal effects, reductions in prey populations and habitat alteration caused by exposure to/use of pesticides.	9.3 Agricultural & forestry effluents	Reduce mortality and sub-lethal effects of pesticides on birds. Reduce the effects of pesticides on prey species.	2.1 Reduce mortality and/or sub-lethal effects from pesticide use 5.1 Maintain natural food webs and prey sources	Substantially reduce the use of pesticides in Canada. Where elimination is not possible, they should be used as part of an IPM system. Improve regulation of pesticides in Canada to reduce bird mortality.	5.2 Policies and regulations 5.3 Private sector standards and codes	**Direct or indirect poisoning by pesticides:** Bald Eagle, Peregrine Falcon (*anatum/tundrius*) , Northern Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Killdeer, Bobolink **Reductions in prey due to pesticide use:** Bald Eagle, Barn Swallow, Black Tern, Common Nighthawk, Northern Rough-winged Swallow, Bank Swallow, Barn Swallow, Chimney Swift, Killdeer
Mortality from ingestion of lead shot or tackle.	5.1 Hunting & collecting terrestrial animals 5.4 Fishing & harvesting aquatic resources	Reduce mortality and sub-lethal effects of lead shot and fishing tackle on birds .	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Work with hunters, anglers and industry to eliminate the exposure of birds to shot, sinkers and jigs made of lead. Enforce the use of non-toxic shot in waterfowl hunting, and encourage adoption of non-toxic alternatives in target shooting, upland game bird hunting, and fishing.	4.3 Awareness and communications 5.4 Compliance and enforcement	Bald Eagle, Waterfowl, Waterbirds
Mortality from heavy metals and other contaminants.	9.2 Industrial & military effluents	Reduce mortality from heavy metals and other contaminants.	2.2 Reduce mortality and/or sub-lethal effects from exposure to contaminants	Work with industry and policy makers to reduce the quantity of heavy metals and other contaminants released into the environment.	5.3 Private sector standards and codes 5.2 Policies and regulations	**Heavy metals:** Common Goldeneye, Common Merganser **PCBs:** Bald Eagle, Common Goldeneye **Other contaminants:** Horned Grebe (western population), Peregrine Falcon (*anatum/tundrius*)

Table 26 continued

Threats addressed	Threat Sub-category	Objective	Objective category	Recommended Actions	Action Sub-category	Example Priority Species Affected
Mortality of waterbirds from oil pollution.	9. Pollution	Reduce mortality from oil pollution.	2.3 Reduce mortality and/or sublethal effects of oil pollution 5.1 Maintain natural food webs and prey sources	Improve monitoring and enforcement capacity to reduce chronic oil pollution from illegal dumping of bilge waste and cleaning of oil tanks. Improve education/outreach to make sure that the oil industry and its regulators are aware of the potential effects on birds and take measures to prevent exposure of birds to oil.	5.4 Compliance and enforcement 4.3 Awareness and communications	**Lethal and sublethal effect of oil exposure:** Bald Eagle, Common Goldeneye, Lesser Scaup, Red Knot (*rufa*)
Population effects of pollution are unknown.	12.1 information lacking	Improve understanding of population effects of pollution.	7.4 Improve understanding of causes of population declines	Evaluate the effects of PBDEs and other chemicals on vital rates in birds. Evaluate the extent to which pesticides are reducing prey availability for aerial insectivores. Improve the ability to monitor and understand the effects of contaminant concentrations in birds. Continue to acquire information on oiling of waterbirds through programs like Birds Oiled at Sea.	8.1 Research 8.2 Monitoring	**PBDE exposure; effects unknown:** Peregrine Falcon (*anatum/tundrius*)
Predation by domestic cats						
Predation by domestic and feral cats.	8.1 Invasive non-native/alien species	Reduce mortality from domestic and feral cats.	2.4 Reduce incidental mortality	Implement a "Cats Indoors!" Campaign following the guidelines of the American Bird Conservancy. (www.abcbirds.org/abcprograms/policy/cats/index.html). Work to reduce feral cat overpopulation through cat control regulations.	5.3 Private sector standards and codes 5.2 Policies and regulations	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting rural, suburban or urban areas

Table 26 continued

Threats addressed	Threat Sub-category	Objective	Objective category	Recommended Actions	Action Sub-category	Example Priority Species Affected
Population effects of cat predation are unknown.	12.1 Information lacking	Improve understanding of population effects of cat predation.	7.4 Improve understanding of causes of population declines	Evaluate which species are most vulnerable to cat predation. Investigate the population-level effects of cat predation through better monitoring of kill rates and the number of feral cats. Continue to monitor bird populations so changes in numbers and distributions can be identified and management of cats can be altered to reflect these changes. Conduct effectiveness monitoring to evaluate if mitigation activities are achieving the desired results.	8.1 Research 8.2 Monitoring	Ground nesting or ground foraging species; species attracted to feeders; species inhabiting suburban or urban areas

Climate Change

The effects of climate change are already measurable in many bird habitats and have resulted in range shifts and changes in the timing of migration and breeding in some species (National Audubon Society, 2009; North American Bird Conservation Initiative, U.S. Committee 2009). Birds in all habitats will be affected by climate change. The most vulnerable are predicted to be those that are dependent on oceanic ecosystems and those found in coastal, island, grassland, arctic and alpine habitats (North American Bird Conservation Initiative, U.S. Committe 2010). Changing climate may also facilitate the spread of disease, the introduction of new predators and the invasion of non-native species that alter habitat structure and community composition (North American Bird Conservation Initiative, U.S. Committee 2009; Faaborg et al. 2010). See Tables 27 and 28 for a summary of effects of climate change and conservation objectives.

A recent exercise used bioclimatic modeling to predict changes in bird species ranges based on anticipated climate change for different time periods and under different emissions scenarios (Lawler et al. 2010; Lawler et al. 2009). Bioclimatic models use statistical associations between the current range of a species and a suite of climate variables to predict future ranges under new climate conditions. The study focused on bird species currently found within Bird Conservation Planning Units in Canada. The results suggest that bird species turnover in Canada will be highest in northern BCRs as species ranges continue to shift northward in the next 30–40 years. In BCR 12 ON, the model predicts a gain of 18 species and a loss of 24 species for a total turnover (species gains + species losses) of 21% (Fig. 29).

Figure 29. Number of species analyzed (blue), gained (red), lost (green), and the percent turnover (reddish brown) by BCR subregion.

The observed changes in climate have been less pronounced in BCR 12 ON in comparison with more northerly BCRs, such as BCR 7 Ontario. Still, the changes have already resulted in measurable habitat and ecological change. A substantial reduction in ice cover on the Great Lakes through the late 1990s and early 21st century led to increased evaporation and a substantial and troubling drop in water levels (up to 1.3 m). Recent years of heavy ice cover have reversed this trend to some extent (Wang et al. 2010), but water surface temperatures remain elevated and summertime evaporation has more than doubled since 1980 in Lakes Michigan and Huron (Hanrahan et al. 2010). These climate-related changes in ice cover, water levels and temperature may have profound effects on the migration and annual distribution of waterfowl populations (i.e., delayed or decreased migration to more southern latitudes; Brook et al. 2009), fish populations upon which many priority bird species prey (Jones et al. 2006), and the regulation of invasive species (Hellmann et al. 2008), or may adversely affect plant diversity and the habitat value of wetlands along the shores of the Great Lakes (Mortsch 1998).

Future climate effects may also be pronounced in the forested habitats of BCR 12 ON. Predicted climatic conditions may promote increased severity of fire, insect outbreaks, and drought (Colombo 2008), with positive and negative effects on priority bird species. Climate envelope modelling suggests that the conditions currently prevailing in ecoregion 6E (i.e. to the south of BCR 12 ON, in BCR 13) could migrate as far north as the coast of Lake Superior by 2100 (McKenney et al. 2010; Ontario Biodiversity Council 2011). These rapid shifts in climate conditions will have consequences for the habitat found here, and could outpace the ability of trees and other plant species, for example, to keep pace with this rate of shift in their preferred climatic conditions (McKenney et al. 2010).

The global scale of predicted climate effects means that conditions encountered elsewhere in the range of BCR 12 ON priority species must also be considered. Those species breeding to the north and migrating through the region face the consequences of the accelerated climate and habitat change observed at high latitudes (ACIA 2005), such as the potential drying of moist tundra or inundation of key coastal staging habitats in BCR 7 Ontario. To the south, sea-level rise may threaten the wintering habitats used by shorebirds (Galbraith et al. 2002), and populations of neotropical landbirds may be affected by changing climate and productivity on their wintering grounds (Wilson et al. 2011)

The highly complex interactions among ecosystem components and among the various stages in birds' annual life cycles make precise predictions difficult. However, although uncertainty remains, it is clear that climate change and the associated habitat changes could significantly affect birds and other wildlife in BCR 12 ON. To maintain healthy bird populations in the face of a changing climate, conservation must be carefully planned and must be implemented so as to buffer birds from the negative effects of climate change wherever possible (Faaborg et al. 2010).

Table 27. Examples of the current and anticipated effects of climate change on bird populations in Canada and some affected birds.

Note: The species shown here do not represent an exhaustive list, but instead provide examples of species where the effects of climate change have been suggested or documented.

Potential and Realized Effects of Climate Change	Examples of Species Affected
Mismatch between peak hatch and peak food abundance	Olive-sided Flycatcher, Rusty Blackbird
Habitat loss as a result of ecosystem changes	Yellow Rail, Black Tern, Solitary Sandpiper
Increase in severe weather events	Bank Swallow, Barn Swallow, Chimney Swift, Common Nighthawk, Olive-sided Flycatcher, Rough-winged Swallow
Introduction of new predators and competitors	Caspian Tern

Table 28. Proposed conservation objectives and actions to address climate change.

Threats Addressed	Threat Sub-category	Objective	Objective Category	Recommended Actions	Action Sub-category	Priority Species Affected
Climate change affects habitat and negatively affects survival and productivity of birds	11.1 Habitat shifting and alteration 11.4 Storms and flooding 11.5 Other impacts	Reduce greenhouse gas emissions	6.1 Support efforts to reduce greenhouse gas emissions	Support efforts to reduce greenhouse gas emissions.	5.2 Policies and regulations	All
		Mitigate the effects of climate change on bird habitat	6.2 Manage for habitat resilience as climate changes	Manage for habitat resilience to allow ecosystems to adapt despite disturbances and changing conditions. Minimize anthropogenic stressors (such as development or pollution) to help maintain resilience.	1.1 Site/area protection	
				Manage buffer areas and the matrix between protected areas to enhance movement of species across the landscape.	2.1 Site/area management	
				Manage ecosystems to maximize carbon storage and sequestration while simultaneously enhancing bird habitat.		
				Incorporate predicted shifts in habitat into landscape level plans (e.g., when establishing protected areas ensure the maintenance of north-south corridors to facilitate northward range shifts of bird species).	5.2 Policies and regulations	
Population-level effects of climate change are unknown	12.1 Information lacking	Improve understanding of climate change on birds and their habitats	7.5 Improve understanding of potential effects of climate change	Evaluate which species are most vulnerable to climate change.	8.1 Research	All
				Investigate the cumulative effects of climate change.		
				Investigate behavioural responses to climate change (such as range shifts, changes in demographic rates, and changes in timing of breeding and migration) through long-term studies.		
				Continue to monitor bird populations so changes in numbers and distributions can be identified.	8.2 Monitoring	
				Undertake monitoring to evaluate the effectiveness of mitigation activities.		

Research and Population Monitoring Needs

Population Monitoring

An estimate of population trend for each species is necessary for the development of elements 1 and 3 (Species Assessment and Population Objectives). However, there are many species for which we are currently unable to estimate a population trend (PT) score. These species were typically assigned a population objective of "assess/maintain." The inability to estimate a PT score may be the result of a lack of monitoring data for the BCR as a whole or may be because information about certain species is not well captured by common monitoring techniques. To be able to effectively evaluate species believed to be of conservation concern, and to track those not yet of concern for future changes in status, we require more comprehensive monitoring that enables us to generate population trends for all species of birds in Canada. However, it is important to note that for some species, population trends are better understood at scales larger or smaller than the BCR unit, and lack of BCR-scale population trend data should not preclude acting to conserve these species.

Human settlements are distributed throughout BCR 12 ON, and road access is generally adequate for volunteer-based monitoring. As a result, coverage of bird surveys here is relatively good in comparison to many other regions in the country. Volunteer-based surveys such as the Breeding Bird Survey and Ontario Breeding Bird Atlas have good participation, and a variety of targeted surveys (e.g., the Eastern Waterfowl Survey, Great Lakes Colonial Waterbird Monitoring Surveys [decadal census and annual efforts], Great Lakes Marsh Monitoring Program, Ontario Shorebird Survey), provide additional monitoring data for species not well covered by other surveys. Still, there are a number of gaps in monitoring information that could be filled with targeted surveys or enhancement of existing surveys. Table 29 provides some suggestions for how these gaps might be filled for the priority species of BCR 12 ON.

A recent Environment Canada review (Avian Monitoring Review Steering Committee 2012) of avian monitoring programs in Canada made the following recommendations for each of the four main species groups:

Landbirds

- develop options for on-the-ground monitoring across boreal Canada;
- evaluate the ability of migration monitoring and checklist surveys to contribute to Environment Canada's monitoring needs; and
- evaluate the feasibility and cost-effectiveness of improving demographic monitoring to help understand causes of population change.

Shorebirds

- develop more reliable sampling methods for counting shorebirds in migration to address concerns about bias; and
- increase Latin American involvement in monitoring shorebirds on the wintering grounds, including Red Knot.

Waterbirds

- evaluate alternative strategies for filling gaps in coverage for both colonial waterbirds and marsh birds;
- consider both costs and potential reduction in risks; and
- carry out any necessary pilot work to evaluate options.

Waterfowl

- develop strategies to reduce expenditures on the prairie and eastern waterfowl breeding surveys, while retaining acceptable precision in population estimates;
- review the information needs and expenditures for duck banding programs.

Table 29. Species categories, monitoring methods and examples of potential priority species in BCR 12 ON for which there are currently not enough data to produce a reliable estimate of the demographic trend across this BCR.

Category	Potential Monitoring Methods	Examples of priority species
Landbirds	Increase the coverage of the Breeding Bird Survey or perform specific surveys of rare, discrete or cryptic birds whose populations are not well known (e.g., high altitude birds, breeding birds in the boreal forest).	Canada Warbler, Field Sparrow, Golden-winged Warbler, Rusty Blackbird, Connecticut Warbler, Mourning Warbler
Aerial insectivores	Develop and implement specific surveys. If possible, conduct regular colony counts (e.g., Chimney Swift roosts). Initial surveys may be needed to find the breeding areas, colonies or roosts. Implement or extend targeted twilight surveys for the Common Nighthawk and Eastern Whip-poor-will. These surveys could be based on the Nightjar Survey Network model (Center for Conservation Biology 2012).	Eastern Whip-poor-will, Common Nighthawk, Bank Swallow, Barn Swallow, Northern Rough-winged Swallow, Chimney Swift, Olive-sided Flycatcher, Eastern Wood-Pewee
Diurnal Raptors	Support Christmas Bird Counts and extend their scope to record the presence of wintering raptors. Support the training of monitors in the identification of raptors. Improve ability to monitor forest raptor populations in BCR 12 ON through improved breeding season surveys and/or analyses of hawk migration count data.	Peregrine Falcon (*anatum/tundrius*) , Broad-winged Hawk, Bald Eagle
Shorebirds	Conduct surveys of breeding birds in the boreal forest. Expand the Ontario Shorebird Survey with more frequent and widespread survey coverage, in order to improve the assessment of numbers of migrant shorebirds in the province.	All priority shorebirds
Inland waterbirds	Support, refine and expand marsh-bird monitoring programs to improve population status and trend reliability.	Yellow Rail, Red-necked Grebe, Common Gallinule

Table 29 continued

Category	Potential Monitoring Methods	Examples of priority species
Waterfowl	Maintain the banding program to monitor the effects of hunting pressure on priority species. Document bird movement and acquire demographic data (survival rate, reproductive success).	All Priority Breeding Waterfowl Species
	Maintain breeding waterfowl monitoring programs.	Black Scoter, Surf Scoter, White-winged Scoter, Greater Scaup, Lesser Scaup, Long-tailed Duck, Common Merganser, Common Goldeneye
	Conduct periodic staging surveys to identify and monitor importance of Great Lakes staging areas to relevant species.	

Research

The focus of this section is to outline the main areas where a lack of information hindered the ability to understand conservation needs and make recommendations for suitable conservation actions. Species or habitat-specific research recommendations are made in Section 2 of this strategy (by habitat). Research objectives presented here are bigger-picture questions and not necessarily a schedule of studies that are required to determine the needs of individual species. Undertaking research will facilitate improvements to future iterations of BCR strategies, focus future implementation, and will also enable the development of new tools for conservation.

Limiting factors are poorly understood for many species of birds in Canada, and several of the research needs below are intended to help understand the causes of decline, or determine the magnitude of specific sources of mortality or disturbance. These include the following (in no particular order):

- Research on species at risk to understand regional biology, status and (potentially) trends, and the relationship of national trends and populations to local data.
- Research to understand and reverse the causes of population declines (e.g., aerial insectivores).
- Research that determines specific population connectivity and migration routes between breeding and wintering areas, using techniques such as genetic analysis, stable isotopes and geolocators.
- Research that links BCR 12 ON priority species with their migration routes and wintering grounds.
- Research to determine specific impacts of development activities (e.g., mining, expanding transportation corridors) on birds to properly understand the local and cumulative effects of these activities (e.g., offshore wind farms and the displacement of birds from staging habitats).
- Research to fill gaps in knowledge about the acidification of lakes and ecotoxicology.
- Research to determine the population-level significance of bird mortality from collisions with anthropogenic structures of all types and predation by domestic cats. Identify particularly vulnerable species.
- Where they do not already exist, conduct research to support the development of sector-specific BMPs documents, with an emphasis on bird and biodiversity conservation. Monitor adherence to these BMPs and assess their effectiveness.
- Map land cover changes that have occurred across BCR 12 ON between the baseline time periods established in BCR strategies and the current day in order to correlate habitat loss with species declines and assess the main types of habitat transitions that have occurred (wetland to urban development, old growth to managed forest, etc.).
- Research to determine species habitat associations to help assess the effects of development activities and refine monitoring programs.
- Research to understand the observed impacts of changing climate on habitats and birds.

In addition, a general research and monitoring need in BCR 12 ON relates to the ongoing improvement of forest management practices for the benefit of birds and other species contributing to biodiversity. Current policies and guidelines for forest management attempt to mimic natural disturbance, and maintain several forest parameters (e.g., forest composition, age class distribution and landscape pattern; Ontario Ministry of Natural Resources 2002) within the ERNV. It is assumed that this pattern of disturbance, seemingly natural at the landscape scale, will support healthy ecological communities and processes, and healthy populations of birds and other biodiversity. Designing and implementing targeted studies to evaluate this assumption and refine forest management practices is an ongoing critical research need. Monitoring the outcome of these studies, and using the results to refine forest management practices at multiple spatial scales is also a critical need. Implementing these hypothesis-driven adaptive management and structured decision-making processes could ensure that forest management practices in BCR 12 ON achieve the desired outcomes for birds and other biodiversity components (Rempel 2009).

Threats Outside Canada

Many bird species found in Canada spend a large portion of their lifecycle outside the country (Fig. 30). These species face threats while they are outside Canada; in fact, threats to some migratory species may be most severe outside the breeding season (Calvert et al., 2009). Of the 100 priority species in BCR 12 ON, 92% are migratory and spend part of their annual life cycle outside Canada.

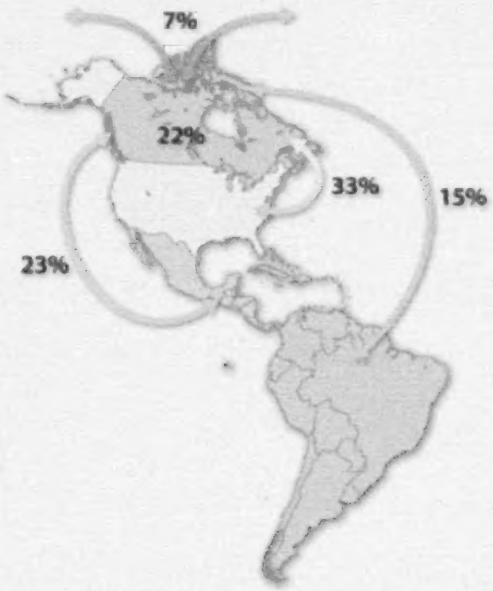

Figure 30. Percent of Canadian breeding birds that migrate to regions outside Canada for part of their life cycle (North American Bird Conservation Initiative 2012).

Similar to our assessment of threats facing priority species within Canada, we conducted a literature review to identify threats facing priority species while they are outside Canada. A lack of data was a pervasive issue for this exercise. For many species, little is known about threats they face during migration or while on their wintering grounds. Indeed, for some species, their wintering ranges and habitat use are only poorly known, if at all. There is also little information linking specific wintering areas to particular breeding populations, making it difficult to connect declines in breeding populations to potential problems on the wintering grounds. In addition, what data exist on wintering migrant species are heavily biased towards work done in the United States, and little research is available from Mexico and Central and South America. While many of the threats identified in the United States likely affect species throughout their range, unique issues outside the United States may have been missed. An absence of threats in a region may reflect that the necessary research has not yet been conducted (or may not be published in English). Because information on bird distributions during the non-breeding season is limited, we were unable to assess the scope and severity of threats to priority species while

they are outside Canada. Based on the number of species potentially affected, habitat loss due to agriculture, development and forestry, pollution, and illegal hunting were among the most important factors influencing priority species' populations during the non-breeding season outside of Canada (Fig. 31).

In addition to habitat loss, priority birds in BCR 12 ON suffer increased mortality due to human-induced threats during migration and wintering. Collisions with human-made structures such as buildings and communication towers represent a significant threat during migration (threat sub-categories 1.1 and 1.2). Exposure to lethal or sub-lethal concentrations of agricultural pesticide (sub-category 9.3) can also cause mortality during migration or at wintering sites, either through direct exposure (poisoning) or indirectly (reduction in prey abundance). Another important cause of mortality among some priority species outside Canada is hunting (sub-category 5.1), including lead poisoning (ingestion of hunting pellets), legal or illegal hunting, and accidental killing of non-target species.

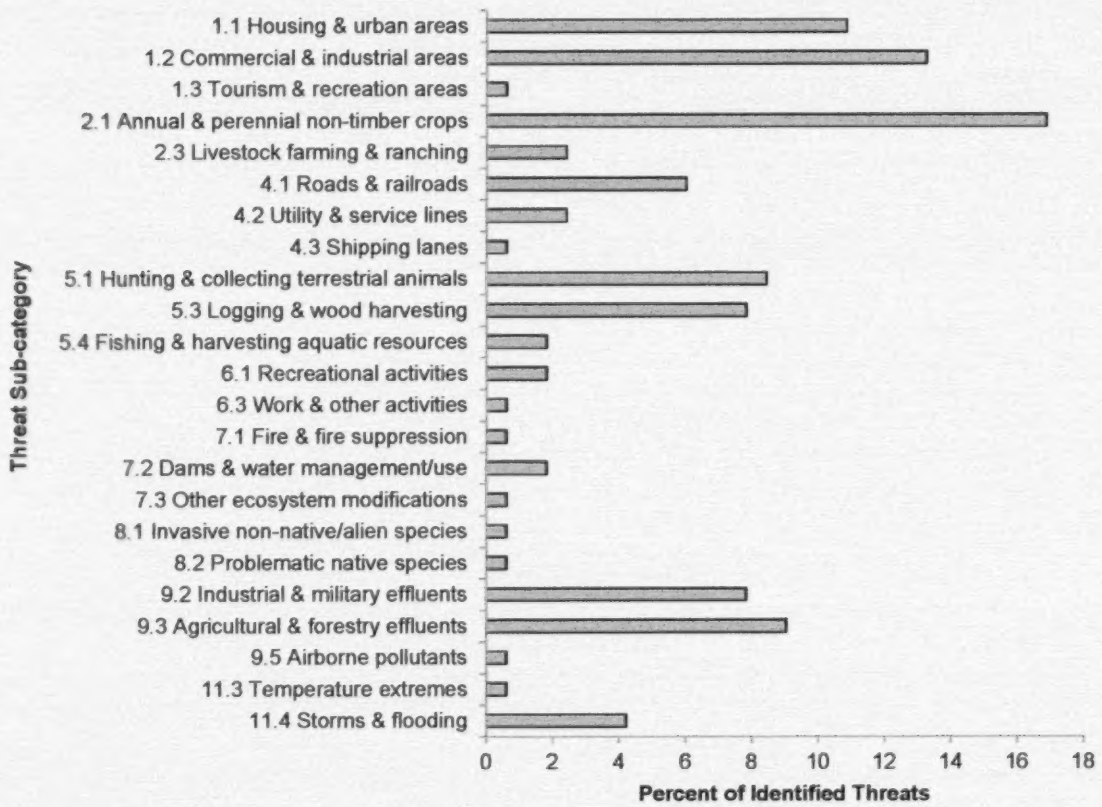

Figure 31. Percent of identified threats to priority species (by threat sub-category) in BCR 12 ON when they are outside Canada.

Note: Magnitudes could not be assigned for threats outside Canada due to lack of information on the scope and severity of threats considered.

Next Steps

The primary aims of BCR strategies are to present Environment Canada's priorities with respect to migratory bird conservation, and to provide a comprehensive overview of the conservation needs of bird populations to practitioners who may then undertake activities that promote bird conservation in Canada and internationally. Users from all levels of government, Aboriginal communities, the private sector, academia, NGOs and citizens will benefit from the information. BCR strategies can be used in many different ways depending on the needs of the user, who may focus on one or more of the elements of the strategy to guide their conservation projects.

BCR strategies will be updated periodically. Errors, omissions and additional sources of information may be provided to Environment Canada at any time for inclusion in subsequent versions.

References

ACIA. 2005. *Arctic Climate Impact Assessment*. Cambridge University Press. 1042 pp. www.acia.uaf.edu

American Bird Conservancy. 2012. *Bird Collisions at Communication Towers*. www.abcbirds.org/abcprograms/policy/collisions/towers.html. Accessed 19 March 2012.

Avian Monitoring Review Steering Committee. 2012. *Environment Canada Avian Monitoring Review – Final Report*. Environment Canada, Ottawa Ontario, xii + 170 pages + 3 appendices.

Bevanger, K. 1998. *Biological and conservation aspects of bird mortality caused by electricity power lines: a review*. Biological Conservation. 86:67-76.

Bishop, C.A. and J.M. Brogan. 2013. *Estimates of avian mortality due to vehicle collisions on the Canadian road network*. Avian Conservation and Ecology – Écologie et conservation des oiseaux 8(2):2. www.ace-eco.org/vol8/iss2/art2/.

Blancher, P.J. 2013. *Estimated number of birds killed by house cats (*Felis catus*) in Canada*. Avian ecology and conservation – Écologie et conservation des oiseaux 8(2):3. www.ace-eco.org/vol8/iss2/art3/.

Bolduc, F., F. Fournier, B. Collins and K. Ross. 2008. *Methods used to determine population baselines and objectives for the Eastern Habitat Joint Venture implementation and evaluation plan 2007-2012*. Unpublished Technical Report (modified by B. Collins and S. Meyer, 2011).

Brook, R.W., R.K. Ross, K.F. Abraham and J.C. Davies. 2009. *Evidence for Black Duck Winter Distribution Change*. Journal of Wildlife Management. 73(1):98–103.

Brown, R.G.B. Revision: Lock, A.R. 2003. Hinterland who's who. *Oil pollution and birds*. www.hww.ca/en/issues-and-topics/oil-pollution-and-birds.html.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, eds. 2007. *Atlas of the Breeding Birds of Ontario, 2001-2005*. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature, Toronto, Ontario. xxii + 706 pp.

Calvert, A.M., C.A. Bishop, R.D. Elliot, E.A. Krebs, T.M. Kydd, C.S. Machtans and G.J. Robertson. 2013. *A synthesis of human-related avian mortality in Canada*. Avian Conservation and Ecology – Écologie et conservation des oiseaux 8(2):11. www.ace-eco.org/vol8/iss2/art11/.

Calvert, A. M., S. J. Walde and P. D. Taylor. 2009. *Non-breeding drivers of population dynamics in seasonal migrants: conservation parallels across taxa*. Avian Conservation and Ecology – Écologie et conservation des oiseaux 4(2): 5. www.ace-eco.org/vol4/iss2/art5/.

Canadian Boreal Forest Agreement. 2010. *The Canadian Boreal Forest Agreement: An historic agreement signifying a new era of joint leadership in the boreal forest*. Available at: http://canadianborealforestagreement.com/media-kit/Boreal-Agreement-Full.pdf.

Canadian Cooperative Wildlife Health Centre. 2007. *Type E Botulism in Birds*. Available at: www.ccwhc.ca/wildlife_health_topics/botulism/botulisme_org.php.

Carleton, T.J. 2000. Vegetation responses to the managed forest landscape of central and northern Ontario. *In* A.H. Perera, D.L. Euler and I.D. Thompson, eds. *Ecology of a Managed Terrestrial Landscape: Patterns and Processes of Forest Landscapes in Ontario*. UBC Press, Vancouver, British Columbia. pp. 178–197.

Center for Conservation Biology. 2012. Nightjar Survey Network. Available at: www.nightjars.org.

Colombo, S.J. 2008. *Ontario's forests and forestry in a changing climate*. Applied Research and Development Branch, Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario. 23 pp.

Cornell Lab of Ornithology. 2013. Birds of North America Online. Available at: http://bna.birds.cornell.edu/bna/.

COSEWIC. 2007a. *COSEWIC status report on the Common Nighthawk* Chordeiles minor. Prepared for the Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32 pp.

COSEWIC. 2007b. *COSEWIC assessment and status report on the Olive-sided Flycatcher* Contopus cooperi *in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp.

COSEWIC. 2007c. *COSEWIC assessment and status report on the Chimney Swift* Chaetura pelagica *in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. vii + 49 pp. www.sararegistry.gc.ca/document/default_e.cfm?documentID=1390.

COSEWIC. 2006. *COSEWIC assessment and status report on the Golden-winged Warbler* Vermivora chrysoptera *in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 30 pp. www.registrelep-sararegistry.gc.ca/document/default_e.cfm?documentID=999.

Donaldson, G., C. Hyslop, G. Morrison, L. Dickson and I. Davidson (eds). 2000. *Canadian Shorebird Conservation Plan*. Canadian Wildlife Service, Environment Canada, Ottawa, Ontario. 27 pp. www.publications.gc.ca/site/eng/402194/publication.html.

Eeva, T. and E. Lehikoinen. 2000. *Recovery of breeding success in wild birds*. Nature 403: 851-852.

Environmental Commissioner of Ontario. 2010. Redefining conservation: Annual Report 2009/2010. Environmental Commissioner of Ontario, Toronto, Ontario. 220 pp. + appendices. www.eco.on.ca/index.php?page=2009-10-annual-report&hl=en_US.

Environment Canada. Management Plan for Temperate Breeding Canada Geese in Ontario. *In prep.*

Environment Canada. 2013a. *Avoidance Guidelines*. Available at: http://ec.gc.ca/paom-itmb/default.asp?lang=En&n=AB36A082-1

Environment Canada, 2013b. *How Much Habitat is Enough?* Third Edition. Environment Canada, Toronto, Ontario. www.ec.gc.ca/Publications/default.asp?lang=En&xml=1B5F659B-B931-4F37-A988-3DD73DF656B7.

Environment Canada. 2013c. *Botulism Deaths Continue on Great Lakes*. Available at: www.ec.gc.ca/scitech/default.asp?lang=En&n=6A2D63E5&xsl=articlesservices,viewfull&po=44DB7C63.

Environment Canada. 2013d. *Bird Conservation Strategy for Bird Conservation Region 12 in Quebec: Boreal Hardwood Transition*. Canadian Wildlife Service, Environment Canada. Québec, Quebec. 131 pages + appendices.

Environment Canada. 2013e. *Bird Conservation Strategy for Bird Conservation Region 7 in Ontario: Taiga Shield and Hudson Plains*. Canadian Wildlife Service, Environment Canada. Ottawa, ON. 87 pp + appendices.

Environment Canada. 2011. *Action Plan for the Piping Plover* (Charadrius melodus circumcinctus) *in Ontario* [Proposed]. Species at Risk Act Action Plan Series. Environment Canada, Ottawa, Ontario. iii + 19 pp. www.sararegistry.gc.ca/document/default_e.cfm?documentID=1935.

Environment Canada. 2010. *Activities to reduce acid rain*. Available at: www.ec.gc.ca/air/default.asp?lang=En&n=F5CBD0BB-1.

Environment Canada. 2003. *Great Lakes Fact Sheet: Fish and wildlife health effects in the Canadian Great Lakes areas of concern*. Environment Canada, Downsview, Ontario. 4 pp. http://publications.gc.ca/site/eng/247069/publication.html.

Faaborg, J., R.T. Holmes, A.D. Anders, K.L. Bildstein, K.M. Dugger, S.A. Gauthreaux, P. Heglund, K.A. Hobson, A.E. Jahn, D.H. Johnson, S.C. Latta, D.J. Levey, P.P. Marra, C.L. Merkord, E. Nol, S.I. Rothstein, T.W.Sherry, T.S. Sillett, F.R. Thompson and N. Warnock. 2010. *Conserving migratory land birds in the New World: Do we know enough?* Ecological Applications 20:398-418.

Federal, Provincial and Territorial Governments of Canada. 2010. *Canadian Biodiversity: Ecosystem Status and Trends 2010*. Canadian Councils of Resource Ministers. Ottawa, Ontario. vi + 142 p.

Fleming, R.A, A.A. Hopkin and J-N. Candau. 2000. Insect and disease disturbance regimes in Ontario's forests. *In* A.H. Perera, D.L. Euler and I.D. Thompson, eds. *Ecology of a Managed Terrestrial Landscape: Patterns and Processes of Forest Landscapes in Ontario*. UBC Press, Vancouver, British Columbia. pp. 141–162.

Food and Agriculture Organization (FAO). 2000. *Land cover classification system* (LCCS). United Nations Food and Agriculture Organization, Rome. www.fao.org/docrep/003/x0596e/x0596e00.htm.

Fox, A.D., M. Desholm, J. Kahlert, T.K. Christensen and I.K. Petersen. 2006. *Information needs to support environmental impact assessment of the effects of European marine offshore wind farms on birds*. Ibis 148: S129-S144.

Franceschini, M.D., C.M. Custer, T.W. Custer, J.M. Reed and L.M. Romero. 2008. *Corticosterone stress response in tree swallows nesting near polychlorinated biphenyl- and dioxin-contaminated rivers*. Environmental Toxicology and Chemistry 27:2326–2331.

Galbraith, H., R. Jones, R. Park, J. Clough, S. Herrod-Julius, B. Harrington and G. Page. 2002. *Global climate change and sea level rise: potential losses of intertidal habitats for shorebirds*. Waterbirds 25: 173-183.

Global Forest Watch. 2000. *Canada's Forests at a Crossroads: An Assessment in the Year 2000*. World Resources Institute. 98 pp. + appendices.

Government of Ontario. 1994. *Crown Forest Sustainability Act*. Available at: www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_94c25_e.htm.

Gratson, M.W. and C. Whitman. 2000. *Characteristics of Idaho elk hunters relative to road access on public lands*. Wildlife Society Bulletin 28: 1016-1022.

Guillemette, M. and J.K. Larsen. 2002. *Post-development Experiments to Detect Anthropogenic Disturbances: The Case of Sea Ducks and Wind Parks*. Ecological Applications 12(3): 868-877.

Hanrahan, J.L., S.V. Kravtsov and P.J. Roebber. 2010. *Connecting past and present climate variability to the water levels of Lakes Michigan and Huron*. Geophysical Research Letters. 37, L01701, http://onlinelibrary.wiley.com/doi/10.1029/2009GL041707/abstract.

Hellmann, J.J., J.E. Byers, B.G. Bierwagen and J.S. Dukes. 2008. *Five potential consequences of climate change for invasive species*. Conservation Biology 22:534-543.

Jones, M.L., B.J. Shuter, Y. Zhao and J.D. Stockwell. 2006. *Forecasting effects of climate change on Great Lakes fisheries: models that link habitat supply to population dynamics can help*. Canadian Journal of Fisheries and Aquatic Sciences 63: 457-468.

Kelley, J. R. Jr., S. Williamson and T.R. Cooper. 2008. *American Woodcock Conservation Plan: A Summary of and Recommendations for Woodcock Conservation in North America*. U.S Fish & Wildlife Publications. Paper 430. 162 pp.

Kennedy, J.A., E.A. Krebs and A.F. Camfield. 2012. *A Manual for Completing All-bird Conservation Plans in Canada*, April 2012 version. Canadian Wildlife Service, Environment Canada. Ottawa, Ontario.

Lawler, J.L., J.-F. Gobeil, A. Baril, K. Lindsay, A. Fenech and N. Comer. 2010. *Potential range shifts of bird species in Canadian Bird Conservation Regions under climate change*. Canadian Wildlife Service, unpublished technical report.

Lawler, J. J., S. L. Shafer, D. White, P. Kareiva, E. P. Maurer, A. R. Blaustein and P. J. Bartlein. 2009. *Projected climate-induced faunal change in the western hemisphere*. Ecology 90: 588-597.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux Jr, M.L. Avery, R.L. Crawford, A.M. Manville II, E.R. Travis and D. Drake. 2012. *An Estimate of Avian Mortality at Communication Towers in the United States and Canada*. PLoS ONE 7(4): e34025. http://www.plosone.org/article/info:doi/10.1371/journal.pone.0034025.

Machtans, C. S., C. H. R Wedeles and E. M Bayne. 2013. *A First Estimate for Canada of the Number of Birds Killed By Colliding with Buildings*. Avian Conservation and Ecology – Écologie et conservation des oiseaux 8(2):6. www.ace-eco.org/vol8/iss2/art6/.

Manville, A.M., II. 2005. Bird strikes and electrocutions at power lines, communication lowers, and wind turbines: state of the art and slate of the science – next steps toward mitigation. *In*: C.J. Ralph and T.D. Rich. *Bird Conservation Implementation in the Americas: Proceedings 3rd International Partners in Flight Conference*. 2002. U.S.D.A. Forest Service. GRT-PSW-191: Albany, CA.

McGauley, E. 2004. *Birds on the Farm: A Stewardship Guide*. Ontario Nature – Federation of Ontario Naturalists, Don Mills, Ontario. 76 pp.

McKenney, D.W., J.H. Pedlar, K. Lawrence, P.A. Gray, S. Colombo and W.J. Crins. 2010. *Current and projected future climatic conditions for ecoregions and selected natural heritage areas in Ontario.* Ontario Ministry of Natural Resources, Forest Research Institute, Applied Research and Development Branch, Climate Change Research Report CCRR-16. Sault Ste. Marie, Ontario. 26 pp. + appendices.

Milko, R., L. Dickson, R. Elliot and G. Donaldson. 2003. *Wings Over Water: Canada's Waterbird Conservation Plan*. Canadian Wildlife Service, Environment Canada, Ottawa, Ontario. 28 pp.

Miller, J.R., L.A. Joyce, R.L. Knight and R.M. King. 1996. *Forest roads and landscape structure in the southern Rocky Mountains*. Landscape Ecology 11: 115-127.

Mineau, P. 2010. *Avian mortality from pesticides used in agriculture in Canada*. Wildlife and Landscape Science Directorate, unpublished report. Environment Canada Science and Technology Branch.

Mora, M.A., D. Musquiz, J.W. Bickham, D.S. Mackenzie, M.J. Hooper, J.K. Szabo and C.W. Matson. 2006. *Biomarkers of exposure and effects of environmental contaminants on swallows nesting along the Rio Grande, Texas, USA*. Environmental Toxicology and Chemistry 25: 1574-1584.

Morris, R.D., D.V. Weseloh, L.R. Wires, C. Pekarik, F.J. Cuthbert and D.J. Moore. 2011. *Population trends of Ring-billed Gulls Breeding on the North American Great Lakes, 1976 to 2009*. Waterbirds 34:202-212.

Mortsch, L.D. 1998. *Assessing the impact of climate change on the Great Lakes shoreline wetlands.* Climatic Change 40: 391-416.

National Audubon Society. 2009. *Birds and climate change – ecological disruption in motion.* National Audubon Society , New York. 16pp.

Nebel, S., A. Mills, J.D. McCracken and P.D. Taylor. 2010. *Declines of aerial insectivores in North America follow a geographic gradient.* Avian Conservation and Ecology – Écologie et conservation des oiseaux 5(2): 1. www.ace-eco.org/vol5/iss2/art1/.

North American Bird Conservation Initiative. 2012. *The State of Canada's Birds, 2012.* Environment Canada, Ottawa, Canada. 36 pp.

North American Bird Conservation Initiative, U.S. Committee. 2010. *The State of the Birds 2010 Report on Climate Change, United States of America.* U.S. Department of Interior, Washington, D.C. 32 pp.

North American Bird Conservation Initiative, U.S. Committee. 2009. *The State of the Birds, United States of America.* U.S. Department of Interior, Washington, D.C. 36 pp.

North American Waterfowl Management Plan (NAWMP), Plan Committee. 2004. *North American Waterfowl Management Plan 2004. Implementation framework: strengthening the biological foundation.* Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales, pp. 106.

Ontario Biodiversity Council. 2011. *Ontario's Biodiversity Strategy, 2011: Renewing our commitment to protecting what sustains us.* Ontario Biodiversity Council, Peterborough, Ontario. 69 pp.

Ontario Biodiversity Council. 2010. *State of Ontario's Biodiversity 2010.* A Report of the Ontario Biodiversity Council, Peterborough, Ontario. 121 pp.

Ontario Eastern Habitat Joint Venture. 2007. *Ontario Eastern Habitat Joint Venture Five-year Implementation Plan 2006-2010.* Environment Canada, Ducks Unlimited Canada, Nature Conservancy of Canada, Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Ministry of Natural Resources and Wildlife Habitat Canada. Unpublished. 94pp.

Ontario Ministry of the Environment. 2013. *Water quality in Ontario 2012 Report.* PIBS 9493e, Queen's Printer for Ontario, Toronto. 92pp.

Ontario Ministry of the Environment. 2009. *Water quality in Ontario 2008 Report.* PIBS 6926e, Queen's Printer for Ontario, Toronto. 64 pp.

Ontario Ministry of Finance. 2005. *Ontario Population Projections, 2004–2031, Ontario and its 49 census divisions.* Queen's Printer for Ontario, Toronto. 98 pp.

Ontario Ministry of Natural Resources. 2013a. *Species at Risk in Ontario (SARO) List.* Available at: www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/MNR_SAR_CSSR_SARO_LST_EN.html

Ontario Ministry of Natural Resources. 2013b. *Recovery Strategies.* Available at: www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/MNR_SAR_SPEC_RCVRY_STRAT_EN.html

Ontario Ministry of Natural Resources. 2012. *Aquatic Invasive Species: Round goby; Zebra mussel.* Available at: www.mnr.gov.on.ca/en/Business/Biodiversity/2ColumnSubPage/STDPROD_068689.html.

Ontario Ministry of Natural Resources. 2011. *A land manager's guide to conserving habitat for forest birds in southern Ontario.* Science and Information Resources Division and Trent University, Queen's Printer for Ontario, Toronto. 87 pp. + appendices.

Ontario Ministry of Natural Resources. 2010a. *Forest Management Guide for Great Lakes – St. Lawrence Landscapes (GLSL Landscape Guide)*. Ontario Ministry of Natural Resources, Queen's Printer for Ontario, Toronto. 44 pp. + appendices. Available at: www.mnr.gov.on.ca/en/Business/Forests/Publication/272845.html

Ontario Ministry of Natural Resources. 2010b. *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (Stand and Site Guide)*. Ontario Ministry of Natural Resources, Queen's Printer for Ontario, Toronto. 170 pp. + appendices. Available at: www.mnr.gov.on.ca/en/Business/Forests/Publication/272847.html

Ontario Ministry of Natural Resources. 2010c. *Pine Shoot Beetle (*Tomicus piniperda (L.)*): Forest health alert*. Available at: www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166995.html.

Ontario Ministry of Natural Resources. 2010d. *Emerald Ash Borer (*Agrilus planipennis*): Forest health alert*. Available at: www.mnr.gov.on.ca/en/Business/Forests/2ColumnSubPage/STEL02_166994.html.

Ontario Ministry of Natural Resources. 2007. *State of the Forest Report, 2006*. Forest Information Series. Queen's Printer for Ontario, Toronto. 590 pp.

Ontario Ministry of Natural Resources. 2002. *State of the Forest Report, 2001*. Queen's Printer for Ontario, Toronto. 338 pp.

Ontario Ministry of Natural Resources. 2001. *Forest management guide for natural disturbance pattern emulation*, Version 3.1. Ontario Ministry of Natural Resources, Queen's Printer for Ontario, Toronto. 40 p.

Ontario Ministry of Natural Resources. 2000. *Sivicultural Guide to Managing Southern Ontario Forests.* Queen's Printer for Ontario, Toronto. 661 pp.

Ontario Partners in Flight. 2008. *Ontario Landbird Conservation Plan: Boreal Softwood Shield, North American Bird Conservation Region 8*. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada. Draft Version 2.0. 79 pp + appendices.

Ontario Stone, Sand and Gravel Association. 2013. *Bank Swallows in Pits & Quarries: Guidance for Aggregate Producers*. Mississauga, Ontario. Available at: www.ossga.com/multimedia/38/fs_bank_swallows-ossga.pdf.

Panjabi, A. O., E. H. Dunn, P. J. Blancher, W. C. Hunter, B. Altman, J. Bart, H. Berlanga, G. S. Butcher, S. K. Davis, D. W. Demarest, R. Dettmers, W. Easton, H. G. de Silva Garza, E. E. Inigo-Elias, D. N. Pashley, C. J. Ralph, T. D. Rich, K. V. Rosenberg, C. M. Rustay, J. M. Ruth, J. S. Wendt and T. C. Will. 2005. *The Partners in Flight Handbook on Species Assessment*. Partners in Flight Science Committee, Technical Series No. 3, 30 pp.

Pearce, J.L. 2011. *Development of habitat objectives for BCR 12*. Unpublished report to Environment Canada. Prepared by Pearce and Associates Ecological Research. 110 pp.

Pekarik, C. and D.V. Weseloh. 1998. *Organochlorine contaminants in Herring Gull eggs from the Great Lakes, 1974-1995: change-point regression analysis and short-term regression*. Environmental Monitoring and Assessment 53: 77-115.

Petersen, I.K., T.K. Christensen, J. Kahlert, M. Desholm and A.D. Fox. 2006. *Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Denmark Ministry of the Environment. 161 pp.

Poole, A. ed. 2009. *The Birds of North America*. Cornell Lab of Ornithology, Ithaca, New York. Available at: http://bna.birds.cornell.edu/.

Quinn, J.S., R.D. Morris, H. Blokpoel, D.V. Weseloh and P.J. Ewins. 1996. *Design and management of bird nesting habitat: tactics for conserving colonial waterbird biodiversity on artificial islands in Hamilton Harbour, Ontario*. Can. J. Fish. Aquat. Sci. 53(Suppl. 1): 45–57.

Rempel, R. 2009. Evaluating the effectiveness of forest management guidelines for conserving biodiversity and ecological processes. *In*: *Proceedings of the Ontario Biodiversity Science Forum Workshop*. Toronto, Ontario. pp. 18-22. Available at: http://obsf.ca/files/2012/03/OBSF_2009_Workshop_Proceedings.pdf#page=18.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N., Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt and T.C. Will. 2004. *Partners in Flight North American Landbird Conservation Plan*. Cornell Lab of Ornithology, Ithaca, NY. 85 pp + appendices.

Ross, R.K., P.A. Smith, B. Campbell, C.A. Friis and R.I.G. Morrison. 2012. *Population trends of shorebirds in southern Ontario, 1974–2009*. Waterbirds 35: 15–24.

Ross, K., K. Abraham, R. Clay, B. Collins, J. Iron, R. James, D. McLachlin and R. Weeber. 2003. *Ontario Shorebird Conservation Plan*. Environment Canada, Downsview, Ontario. 48 pp.

Salafsky, N., D. Salzer, A. J. Stattersfield, C. Hilton-Taylor, R. Neugarten, S. H. M. Butchart, B. Collen, N. Cox, L. L. Master, S. O'Connor and D. Wilkie. 2008. *A standard lexicon for biodiversity conservation: Unified classifications of threats and actions*. Conservation Biology 22(4): 897-911.

Sanderson, L.A., J.A. McLaughlin and P.M. Antunes. 2012. *The last great forest: a review of the status of invasive species in the North American boreal forest*. Forestry doi:10.1093/forestry/cps033.

Sandilands, A. 2010. *The birds of Ontario: habitat requirements, limiting factors and status. Nonpasserines: Shorebirds through Woodpeckers*. UBC Press, Vancouver, British Columbia. 387 pp.

Sandilands, A. 2005. *The birds of Ontario: habitat requirements, limiting factors and status. Nonpasserines: Waterfowl through Cranes*. UBC Press, Vancouver, British Columbia. 365 pp.

Scheuhammer, A.M., S.L. Money, D.A. Kirk and G. Donaldson. 2003. *Lead fishing sinkers and jigs in Canada: Review of their use patterns and toxic impacts on wildlife*. Canadian Wildlife Service Occasional Paper No. 108. Environment Canada, Ottawa, Ontario.

Scheuhammer, A.M. and S.L. Norris. 1996. *The ecotoxicology of lead shot and lead fishing weights*. Ecotoxicology 5: 297-295.

Seaway Corporation. 2012. *The St. Lawrence Seaway*. Available at: www.greatlakes-seaway.com/en/pdf/seawaybrochure.pdf

Snell, E. 1987. *Wetland distribution and conversion in Southern Ontario*. Working Paper 48, Inland Waters and Lands Directorate, Environment Canada, Ottawa, Ontario.

Species at Risk Public Registry. 2013. *Recovery Strategies*. Available at: www.sararegistry.gc.ca/sar/recovery/recovery_e.cfm.

Spectranalysis Inc. 2004. *Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes*. Report to Ontario Ministry of Natural Resources. Unpublished.

Switalski, T.A., J.A. Bissonette, T.H. DeLuca, C.H. Luce and M. A. Madej. 2004. *Benefits and impacts of road removal*. Frontiers in Ecology and the Environment 2: 21-28.

Thompson, I.D. 2000. Forest vegetation of Ontario: factors influencing landscape change. *In*: A.H. Perera, D.L. Euler and I.D. Thompson, eds. *Ecology of a Managed Terrestrial Landscape: Patterns and Processes of Forest Landscapes in Ontario*. UBC Press, Vancouver, British Columbia. pp. 30–53.

Wang, J., X. Bai, G. Leshkevich, M. Colton, A. Clites and B. Lofgren. 2010. *Severe ice cover on Great Lakes during winter 2008-2009*. Eos, Transactions, American Geophysical Union 91: 41-42.

Wedeles, C. and S. Mainguy. 2010. *Assessment of Threats in Ontario Bird Conservation Regions*. Unpublished Report Prepared by ArborVitae and North-South Environmental Inc. for Environment Canada. 43pp.

Wilson, S., S.L. LaDeau, A.P. Tøttrup and P.P. Marra. 2011. *...ange-wide effects of breeding- and nonbreeding-season climate on the abundance of a Neotropical migrant songbird*. Ecology 92: 1789–1798. http://dx.doi.org/10.1890/10-1757.1.

World Bank Indicators. 2012. *Roads; paved (% of total roads) in Canada*. World Bank www.tradingeconomics.com/canada/roads-paved-percent-of-total-roads-wb-data.html. Accessed 5 April 2012.

Zeran, R., A. Sandilands, K. Abraham, B. Collins, A. Couturier, D. Kraus, J. McCraken, D. McRae, S. Meyer, R. Morris, C. Pekarik, D. Sutherland and C. Weseloh. 2009. *Ontario Waterbird Conservation Plan (Draft)*. Environment Canada-Canadian Wildlife Service (Ontario Region) and Ontario Ministry of Natural Resources. 106pp.

Zimmerling, J.R., A. Pomeroy, M.V. d'Entremont and C.M. Francis. 2013. *Canadian Estimate of bird mortality due to collisions and direct habitat loss associated with wind turbine developments*. Avian Conservation and Ecology – Écologie et conservation des oiseaux 8(2): 10. www.ace-eco.org/vol8/iss2/art10/.

Appendix 1

List of All Bird Species Occurring in BCR 12 ON

Table A1. Complete list of species in BCR 12 ON, when they are in the BCR (breeding, migrant, wintering) and their priority status.

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Alder Flycatcher	*Empidonax alnorum*	Landbird	Y			
American Crow	*Corvus brachyrhynchos*	Landbird	Y			
American Goldfinch	*Spinus tristis*	Landbird	Y		Y	
American Kestrel	*Falco sparverius*	Landbird	Y			Y
American Pipit	*Anthus rubescens*	Landbird		Y		
American Redstart	*Setophaga ruticilla*	Landbird	Y			
American Robin	*Turdus migratorius*	Landbird	Y		Y	
American Three-toed Woodpecker	*Picoides dorsalis*	Landbird	Y		Y	
American Tree Sparrow	*Spizella arborea*	Landbird			Y	
Bald Eagle	*Haliaeetus leucocephalus*	Landbird	Y			Y
Baltimore Oriole	*Icterus galbula*	Landbird	Y			
Bank Swallow	*Riparia riparia*	Landbird	Y			Y
Barn Swallow	*Hirundo rustica*	Landbird	Y			Y
Barred Owl	*Strix varia*	Landbird	Y		Y	
Bay-breasted Warbler	*Setophaga castanea*	Landbird	Y			Y
Belted Kingfisher	*Megaceryle alcyon*	Landbird	Y			Y
Black-and-white Warbler	*Mniotilta varia*	Landbird	Y			
Black-backed Woodpecker	*Picoides arcticus*	Landbird	Y		Y	
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Landbird	Y			Y
Blackburnian Warbler	*Setophaga fusca*	Landbird	Y			Y
Black-capped Chickadee	*Poecile atricapillus*	Landbird	Y		Y	
Black-throated Blue Warbler	*Setophaga caerulescens*	Landbird	Y			Y
Black-throated Green Warbler	*Setophaga virens*	Landbird	Y			Y
Blue Jay	*Cyanocitta cristata*	Landbird	Y		Y	
Blue-gray Gnatcatcher	*Polioptila caerulea*	Landbird	Y			
Blue-headed Vireo	*Vireo solitarius*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Blue-winged Warbler	*Vermivora cyanoptera*	Landbird	Y			
Bobolink	*Dolichonyx oryzivorus*	Landbird	Y			Y
Bohemian Waxwing	*Bombycilla garrulus*	Landbird			Y	
Boreal Chickadee	*Poecile hudsonicus*	Landbird	Y		Y	
Boreal Owl	*Aegolius funereus*	Landbird	Y		Y	
Brewer's Blackbird	*Euphagus cyanocephalus*	Landbird	Y			
Broad-winged Hawk	*Buteo platypterus*	Landbird	Y			Y
Brown Creeper	*Certhia americana*	Landbird	Y		Y	
Brown Thrasher	*Toxostoma rufum*	Landbird	Y			Y
Brown-headed Cowbird	*Molothrus ater*	Landbird	Y			
Canada Warbler	*Cardellina canadensis*	Landbird	Y			Y
Cape May Warbler	*Setophaga tigrina*	Landbird	Y			
Carolina Wren	*Thryothorus ludovicianus*	Landbird	Y			
Cedar Waxwing	*Bombycilla cedrorum*	Landbird	Y		Y	
Cerulean Warbler	*Setophaga cerulea*	Landbird	Y			Y
Chestnut-sided Warbler	*Setophaga pensylvanica*	Landbird	Y			Y
Chimney Swift	*Chaetura pelagica*	Landbird	Y			Y
Chipping Sparrow	*Spizella passerina*	Landbird	Y			
Clay-colored Sparrow	*Spizella pallida*	Landbird	Y			
Cliff Swallow	*Petrochelidon pyrrhonota*	Landbird	Y			Y
Common Grackle	*Quiscalus quiscula*	Landbird	Y			
Common Nighthawk	*Chordeiles minor*	Landbird	Y			Y
Common Raven	*Corvus corax*	Landbird	Y		Y	
Common Redpoll	*Acanthis flammea*	Landbird			Y	
Common Yellowthroat	*Geothlypis trichas*	Landbird	Y			Y
Connecticut Warbler	*Oporornis agilis*	Landbird	Y			Y
Cooper's Hawk	*Accipiter cooperii*	Landbird	Y			
Dark-eyed Junco	*Junco hyemalis*	Landbird	Y		Y	
Downy Woodpecker	*Picoides pubescens*	Landbird	Y		Y	
Eastern Bluebird	*Sialia sialis*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Eastern Kingbird	*Tyrannus tyrannus*	Landbird	Y			
Eastern Meadowlark	*Sturnella magna*	Landbird	Y			
Eastern Phoebe	*Sayornis phoebe*	Landbird	Y			
Eastern Screech-Owl	*Megascops asio*	Landbird	Y		Y	
Eastern Towhee	*Pipilo erythrophthalmus*	Landbird	Y			Y
Eastern Whip-poor-will	*Antrostomus vociferus*	Landbird	Y			Y
Eastern Wood-Pewee	*Contopus virens*	Landbird	Y			Y
European Starling	*Sturnus vulgaris*	Landbird	Y		Y	
Evening Grosbeak	*Coccothraustes vespertinus*	Landbird	Y		Y	Y
Field Sparrow	*Spizella pusilla*	Landbird	Y			Y
Golden-crowned Kinglet	*Regulus satrapa*	Landbird	Y		Y	
Golden-winged Warbler	*Vermivora chrysoptera*	Landbird	Y			Y
Grasshopper Sparrow	*Ammodramus savannarum*	Landbird	Y			
Gray Catbird	*Dumetella carolinensis*	Landbird	Y			Y
Gray Jay	*Perisoreus canadensis*	Landbird	Y		Y	
Great Crested Flycatcher	*Myiarchus crinitus*	Landbird	Y			
Great Gray Owl	*Strix nebulosa*	Landbird	Y		Y	Y
Great Horned Owl	*Bubo virginianus*	Landbird	Y		Y	
Gyrfalcon	*Falco rusticolus*	Landbird			Y	
Hairy Woodpecker	*Picoides villosus*	Landbird	Y		Y	
Hermit Thrush	*Catharus guttatus*	Landbird	Y			
Hoary Redpoll	*Acanthis hornemanni*	Landbird			Y	
Horned Lark	*Eremophila alpestris*	Landbird	Y			
House Finch	*Haemorhous mexicanus*	Landbird	Y		Y	
House Sparrow	*Passer domesticus*	Landbird	Y		Y	
House Wren	*Troglodytes aedon*	Landbird	Y			
Indigo Bunting	*Passerina cyanea*	Landbird	Y			
Kirtland's Warbler	*Setophaga kirtlandii*	Landbird	Y			Y
Lapland Longspur	*Calcarius lapponicus*	Landbird			Y	
Le Conte's Sparrow	*Ammodramus leconteii*	Landbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Least Flycatcher	*Empidonax minimus*	Landbird	Y			Y
Lincoln's Sparrow	*Melospiza lincolnii*	Landbird	Y			
Loggerhead Shrike (*migrans*)	*Lanius ludovicianus migrans*	Landbird	Y			Y
Long-eared Owl	*Asio otus*	Landbird	Y		Y	
Louisiana Waterthrush	*Parkesia motacilla*	Landbird	Y			Y
Magnolia Warbler	*Setophaga magnolia*	Landbird	Y			
Marsh Wren	*Cistothorus palustris*	Landbird	Y			
Merlin	*Falco columbarius*	Landbird	Y			
Mourning Dove	*Zenaida macroura*	Landbird	Y		Y	
Mourning Warbler	*Geothlypis philadelphia*	Landbird	Y			Y
Nashville Warbler	*Oreothlypis ruficapilla*	Landbird	Y			Y
Northern Cardinal	*Cardinalis cardinalis*	Landbird	Y		Y	
Northern Flicker	*Colaptes auratus*	Landbird	Y			Y
Northern Goshawk	*Accipiter gentilis*	Landbird	Y		Y	Y
Northern Harrier	*Circus cyaneus*	Landbird	Y			
Northern Hawk Owl	*Surnia ulula*	Landbird	Y		Y	
Northern Mockingbird	*Mimus polyglottos*	Landbird	Y		Y	
Northern Parula	*Setophaga americana*	Landbird	Y			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Landbird	Y			Y
Northern Saw-whet Owl	*Aegolius acadicus*	Landbird	Y		Y	
Northern Shrike	*Lanius excubitor*	Landbird			Y	
Northern Waterthrush	*Parkesia noveboracensis*	Landbird	Y			
Olive-sided Flycatcher	*Contopus cooperi*	Landbird	Y			Y
Orchard Oriole	*Icterus spurius*	Landbird	Y			
Osprey	*Pandion haliaetus*	Landbird	Y			
Ovenbird	*Seiurus aurocapilla*	Landbird	Y			
Palm Warbler	*Setophaga palmarum*	Landbird	Y			
Peregrine Falcon *(anatum/tundrius)*	*Falco peregrines anatum*	Landbird	Y			Y
Philadelphia Vireo	*Vireo philadelphicus*	Landbird	Y			
Pileated Woodpecker	*Dryocopus pileatus*	Landbird	Y		Y	

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Pine Grosbeak	*Pinicola enucleator*	Landbird	Y		Y	
Pine Siskin	*Spinus pinus*	Landbird	Y		Y	
Pine Warbler	*Setophaga pinus*	Landbird	Y			
Prairie Warbler	*Setophaga discolor*	Landbird	Y			Y
Purple Finch	*Haemorhous purpureus*	Landbird	Y		Y	Y
Purple Martin	*Progne subis*	Landbird	Y			Y
Red Crossbill	*Loxia curvirostra*	Landbird	Y		Y	Y
Red-breasted Nuthatch	*Sitta canadensis*	Landbird	Y		Y	
Red-eyed Vireo	*Vireo olivaceus*	Landbird	Y			
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Landbird	Y			Y
Red-shouldered Hawk	*Buteo lineatus*	Landbird	Y			Y
Red-tailed Hawk	*Buteo jamaicensis*	Landbird	Y			
Red-winged Blackbird	*Agelaius phoeniceus*	Landbird	Y			
Ring-necked Pheasant	*Phasianus colchicus*	Landbird	Y		Y	
Rock Pigeon	*Columba livia*	Landbird	Y		Y	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Landbird	Y			Y
Ruby-crowned Kinglet	*Regulus calendula*	Landbird	Y			Y
Ruby-throated Hummingbird	*Archilochus colubris*	Landbird	Y			
Ruffed Grouse	*Bonasa umbellus*	Landbird	Y		Y	Y
Rusty Blackbird	*Euphagus carolinus*	Landbird	Y			Y
Savannah Sparrow	*Passerculus sandwichensis*	Landbird	Y			
Scarlet Tanager	*Piranga olivacea*	Landbird	Y			
Sedge Wren	*Cistothorus platensis*	Landbird	Y			Y
Sharp-shinned Hawk	*Accipiter striatus*	Landbird	Y			
Sharp-tailed Grouse	*Tympanuchus phasianellus*	Landbird	Y		Y	
Short-eared Owl	*Asio flammeus*	Landbird	Y			Y
Snow Bunting	*Plectrophenax nivalis*	Landbird			Y	
Snowy Owl	*Bubo scandiacus*	Landbird			Y	
Song Sparrow	*Melospiza melodia*	Landbird	Y			Y
Spruce Grouse	*Falcipennis canadensis*	Landbird	Y		Y	

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Swainson's Thrush	*Catharus ustulatus*	Landbird	Y			
Swamp Sparrow	*Melospiza georgiana*	Landbird	Y			Y
Tennessee Warbler	*Oreothlypis peregrina*	Landbird	Y			Y
Tree Swallow	*Tachycineta bicolor*	Landbird	Y			Y
Turkey Vulture	*Cathartes aura*	Landbird	Y			
Veery	*Catharus fuscescens*	Landbird	Y			Y
Vesper Sparrow	*Pooecetes gramineus*	Landbird	Y			Y
Warbling Vireo	*Vireo gilvus*	Landbird	Y			
Western Kingbird	*Tyrannus verticalis*	Landbird	Y			
Western Meadowlark	*Sturnella neglecta*	Landbird	Y			
White-breasted Nuthatch	*Sitta carolinensis*	Landbird	Y		Y	
White-throated Sparrow	*Zonotrichia albicollis*	Landbird	Y			Y
White-winged Crossbill	*Loxia leucoptera*	Landbird	Y		Y	
Wild Turkey	*Meleagris gallopavo*	Landbird	Y		Y	
Willow Flycatcher	*Empidonax traillii*	Landbird	Y			
Wilson's Warbler	*Cardellina pusilla*	Landbird	Y			
Winter Wren	*Troglodytes hiemalis*	Landbird	Y			
Wood Thrush	*Hylocichla mustelina*	Landbird	Y			Y
Yellow Warbler	*Setophaga petechia*	Landbird	Y			
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Landbird	Y			
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Landbird	Y			Y
Yellow-billed Cuckoo	*Coccyzus americanus*	Landbird	Y			
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Landbird	Y			
Yellow-rumped Warbler	*Setophaga coronata*	Landbird	Y			
Yellow-throated Vireo	*Vireo flavifrons*	Landbird	Y			
American Golden-Plover	*Pluvialis dominica*	Shorebird		Y		
American Woodcock	*Scolopax minor*	Shorebird	Y			Y
Buff-breasted Sandpiper	*Tryngites subruficollis*	Shorebird		Y		
Dunlin	*Calidris alpina*	Shorebird		Y		
Eskimo Curlew	*Numenius borealis*	Shorebird		Y		

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Greater Yellowlegs	*Tringa melanoleuca*	Shorebird		Y		
Killdeer	*Charadrius vociferus*	Shorebird	Y			Y
Least Sandpiper	*Calidris minutilla*	Shorebird		Y		
Lesser Yellowlegs	*Tringa flavipes*	Shorebird		Y		
Long-billed Dowitcher	*Limnodromus scolopaceus*	Shorebird		Y		
Marbled Godwit	*Limosa fedoa*	Shorebird	Y			
Pectoral Sandpiper	*Calidris melanotos*	Shorebird		Y		
Piping Plover (*circumcinctus*)	*Charadrius melodus circumcinctus*	Shorebird	Y			Y
Purple Sandpiper	*Calidris maritima*	Shorebird		Y		
Red Knot (*rufa*)	*Calidris canutus rufa*	Shorebird		Y		Y
Red-necked Phalarope	*Phalaropus lobatus*	Shorebird		Y		
Ruddy Turnstone	*Arenaria interpres*	Shorebird		Y		
Sanderling	*Calidris alba*	Shorebird		Y		
Semipalmated Plover	*Charadrius semipalmatus*	Shorebird		Y		
Semipalmated Sandpiper	*Calidris pusilla*	Shorebird		Y		
Short-billed Dowitcher	*Limnodromus griseus*	Shorebird		Y		
Solitary Sandpiper	*Tringa solitaria*	Shorebird	Y			Y
Spotted Sandpiper	*Actitis macularius*	Shorebird	Y			Y
Stilt Sandpiper	*Calidris himantopus*	Shorebird		Y		
Upland Sandpiper	*Bartramia longicauda*	Shorebird	Y			
Whimbrel	*Numenius phaeopus*	Shorebird		Y		
White-rumped Sandpiper	*Calidris fuscicollis*	Shorebird		Y		
Wilson's Phalarope	*Phalaropus tricolor*	Shorebird	Y			
Wilson's Snipe	*Gallinago delicata*	Shorebird	Y			Y
American Bittern	*Botaurus lentiginosus*	Waterbird	Y			
American Coot	*Fulica americana*	Waterbird	Y			Y
American White Pelican	*Pelecanus erythrorhynchos*	Waterbird	Y			Y
Black Tern	*Chlidonias niger*	Waterbird	Y			Y
Black-crowned Night-Heron	*Nycticorax nycticorax*	Waterbird	Y			Y
Bonaparte's Gull	*Chroicocephalus philadelphia*	Waterbird	Y			

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Caspian Tern	*Hydroprogne caspia*	Waterbird	Y			Y
Common Gallinule	*Gallinula galeata*	Waterbird	Y			Y
Common Loon	*Gavia immer*	Waterbird	Y			
Common Tern	*Sterna hirundo*	Waterbird	Y			Y
Double-crested Cormorant	*Phalacrocorax auritus*	Waterbird	Y			
Eared Grebe	*Podiceps nigricollis*	Waterbird	Y			
Forster's Tern	*Sterna forsteri*	Waterbird	Y			
Glaucous Gull	*Larus hyperboreus*	Waterbird		Y		
Great Black-backed Gull	*Larus marinus*	Waterbird	Y		Y	Y
Great Blue Heron	*Ardea herodias*	Waterbird	Y			
Green Heron	*Butorides virescens*	Waterbird	Y			Y
Herring Gull	*Larus argentatus*	Waterbird	Y			Y
Horned Grebe (western population)	*Podiceps auritus*	Waterbird	Y			Y
Least Bittern	*Ixobrychus exilis*	Waterbird	Y			Y
Little Gull	*Hydrocoloeus minutus*	Waterbird	Y			
Pied-billed Grebe	*Podilymbus podiceps*	Waterbird	Y			
Red-necked Grebe	*Podiceps grisegena*	Waterbird	Y			Y
Red-throated Loon	*Gavia stellata*	Waterbird		Y		
Ring-billed Gull	*Larus delawarensis*	Waterbird	Y			
Sandhill Crane	*Grus canadensis*	Waterbird	Y			Y
Sora	*Porzana carolina*	Waterbird	Y			
Virginia Rail	*Rallus limicola*	Waterbird	Y			
Yellow Rail	*Coturnicops noveboracensis*	Waterbird	Y			Y
American Black Duck	*Anas rubripes*	Waterfowl	Y			Y
American Wigeon	*Anas americana*	Waterfowl	Y			
Black Scoter	*Melanitta americana*	Waterfowl		Y		Y
Blue-winged Teal	*Anas discors*	Waterfowl	Y			
Brant	*Branta bernicla*	Waterfowl		Y		
Bufflehead	*Bucephala albeola*	Waterfowl	Y			Y
Cackling Goose	*Branta hutchinsii*	Waterfowl		Y		

Table A1 continued

Common Name	Scientific Name	Bird Group	Breeding	Migrant	Wintering	Priority
Canada Goose (Southern James Bay population)	*Branta canadensis*	Waterfowl		Y		Y
Canada Goose (Eastern Temperate-breeding population)	*Branta canadensis*	Waterfowl	Y			Y
Canvasback	*Aythya valisineria*	Waterfowl		Y		
Common Goldeneye	*Bucephala clangula*	Waterfowl	Y			Y
Common Merganser	*Mergus merganser*	Waterfowl	Y		Y	Y
Gadwall	*Anas strepera*	Waterfowl	Y			
Greater Scaup	*Aythya marila*	Waterfowl		Y		Y
Green-winged Teal	*Anas crecca*	Waterfowl	Y			Y
Hooded Merganser	*Lophodytes cucullatus*	Waterfowl	Y			Y
Lesser Scaup	*Aythya affinis*	Waterfowl		Y		Y
Long-tailed Duck	*Clangula hyemalis*	Waterfowl		Y	Y	Y
Mallard	*Anas platyrhynchos*	Waterfowl	Y			Y
Northern Pintail	*Anas acuta*	Waterfowl	Y			
Northern Shoveler	*Anas clypeata*	Waterfowl	Y			
Red-breasted Merganser	*Mergus serrator*	Waterfowl	Y			
Redhead	*Aythya americana*	Waterfowl	Y			
Ring-necked Duck	*Aythya collaris*	Waterfowl	Y			Y
Ruddy Duck	*Oxyura jamaicensis*	Waterfowl	Y			
Snow Goose	*Chen caerulescens*	Waterfowl		Y		
Surf Scoter	*Melanitta perspicillata*	Waterfowl		Y		Y
Trumpeter Swan	*Cygnus buccinator*	Waterfowl	Y			
Tundra Swan	*Cygnus columbianus*	Waterfowl		Y		
White-winged Scoter	*Melanitta fusca*	Waterfowl		Y		Y
Wood Duck	*Aix sponsa*	Waterfowl	Y			Y

Appendix 2

General Methodology for Compiling the Six Standard Elements

Each strategy includes six required elements to conform to the national standard. An extensive manual (Kennedy et al. 2012) provides methods and other guidance for completing each element. The six elements provide an objective means of moving towards multi-species conservation efforts that are targeted to species and issues of highest priority. The six elements are:

1) identifying priority species – to focus conservation attention on species of conservation concern and those most representative of the region
2) attributing priority species to habitat classes – a tool for identifying habitats of conservation interest and a means of organizing and presenting information
3) setting population objectives for priority species – an assessment of current population status compared to the desired status, and a means of measuring conservation success
4) assessing and ranking threats – identifies the relative importance of issues affecting populations of priority species within the planning area as well as outside Canada (i.e., throughout their life cycle)
5) setting conservation objectives – outlines the overall conservation goals in response to identified threats and information needs; also a means of measuring accomplishments
6) proposing recommended actions – strategies to begin on-the-ground conservation to help achieve conservation objectives.

The first four elements apply to individual priority species, and together comprise an assessment of the status of priority species and the threats they face. The last two elements integrate information across species to create a vision for conservation implementation both within Canada and in countries that host priority species during migration and the non-breeding season.

Element 1: Species Assessment to Identify Priority Species

The Bird Conservation Strategies identify "priority species" from all regularly occurring bird species in each subregion. The priority species approach allows management attention and limited resources to focus on those species with particular conservation importance, ecological significance and/or management need. The species assessment processes used are derived from standard assessment protocols developed by the four major bird conservation initiatives.[11]

The species assessment process applies quantitative rule sets to biological data for factors such as:

- population size,
- breeding and non-breeding distribution,

[11] Partners in Flight (landbirds), Wings Over Water (waterbirds), Canadian Shorebird Conservation Plan (shorebirds), North American Waterfowl Management Plan (waterfowl).

- population trend,
- breeding and non-breeding threats, and
- regional density and abundance.

The assessment is applied to individual bird species and ranks each species in terms of its biological vulnerability and population status. The assessments can be used to assign subregional (i.e., provincial section of a BCR), regional (BCR) and continental conservation priorities among birds.

For waterfowl, species that were identified within the OEHJV Implementation Plan as being high priority breeding or non-breeding within Ontario BCR 12 were added to the all-bird priority species list (Ontario Eastern Habitat Joint Venture 2007). Similarly, species considered by NAWMP (NAWMP Plan Committee 2004) to have breeding or non-breeding needs of Moderately High, High or Highest for Waterfowl Conservation Region (WCR) 12 were added. In some cases, additions and exclusions were made to the priority lists based on more recent Canadian Wildlife Service (CWS) expert opinion (J. Hughes, S. Meyer, S. Badzinski, pers. comm. 2011).

For landbirds, species were included on the priority species list if they are considered to be of Continental Concern, Regional Concern, Continental Stewardship, Regional Stewardship, or Management Interest in the Ontario Partners in Flight Plan (2008). Again, in some cases, additions or exclusions were made to the list based on CWS expert opinion (M. Cadman, R. Russell, pers comm. 2012).

Shorebirds that had been identified as high or medium priority in the Ontario Shorebird Conservation Plan (Ross et al. 2003) and verified by expert opinion (K. Ross, pers. comm. 2009, C. Friis, pers. comm. 2011) were included in the all bird priority list, with those noted as low priority generally excluded.

Priority waterbird species were those that were designated as Tier 1 or Tier 2 within BCR 12 in the Ontario Waterbird Conservation Plan (Zeran et al. 2009), with some changes made based on recent expert opinion (D. Moore, D.V. Weseloh, P. Hubert, pers. comm. 2011). Provincial and/or federal species at risk occurring in BCR 12 ON were also identified as priority species (current to November 2013).

Element 2: Habitat Associations for Priority Species

Identifying the broad habitat requirements for each priority species in the breeding and non-breeding season allows species with shared habitat-based conservation issues or actions to be grouped. If many priority species associated with the same habitat class face similar conservation issues, then conservation action in that habitat class may support populations of several priority species. In most cases, all habitat associations identified in the literature are listed for individual species. Habitat associations do not indicate relative use, suitability ratings or rankings, nor selection or avoidance; this could be a useful exercise to undertake in the future.

In order to link with other national and international land classification schemes and to capture the range of habitat types across Canada, habitat classes for all priority species are based, at the coarsest level, on the hierarchical approach of the LCCS developed by the United Nations Food and Agriculture Organization (Food and Agriculture Organization 2000). Some modifications were made to the LCCS scheme to reflect habitat types that are important to birds that are not included in the classification (e.g., marine habitats). Species often are assigned to more than one of these coarse habitat classes. To retain the link to regional spatial data (provincial forest inventories, etc.), or to group species into regionally relevant habitat classes, individual BCR strategies may identify finer-scale habitat classes. Finer-scale habitat attributes and the surrounding landscape context were also captured when possible to better guide the development of specific conservation objectives and actions. For BCR 12 ON, habitat associations and descriptions were defined for priority species based largely on information in Cadman et al. (2007) and the Birds of North America Online (Cornell Lab of Ornithology 2013).

Element 3: Population Objectives for Priority Species

A central component of effective conservation planning is setting clear objectives that can be measured and evaluated. Bird Conservation Strategies set objectives based upon the conservation philosophies of national and continental bird initiatives, including the North American Bird Conservation Initiative (NABCI), that support conserving the distribution, diversity and abundance of birds throughout their historical ranges. The baselines for population objectives used in this planning exercise (those existing during the late 1960s, 1970s and 1990s for eastern waterfowl) reflect population levels prior to widespread declines. Most of the four bird conservation initiatives under the umbrella of NABCI have adopted the same baselines at the continental and national scale (waterfowl, shorebirds and landbirds; national and continental waterbird plans have not yet set population objectives). Some regions in the current planning effort have adjusted baselines to reflect the start of systematic monitoring (e.g., the Eastern Waterfowl Survey in Ontario began in the early- to mid-nineties). The ultimate measure of conservation success will be the extent to which population objectives have been reached. Progress towards population objectives will be regularly assessed as part of an adaptive management approach.

Population objectives for all bird groups are based on a quantitative or qualitative assessment of species' population trends. If the population trend for a species is unknown, the objective is usually "assess and maintain," and a monitoring objective is set. Harvested waterfowl and many stewardship species may already be at desired population levels and are thus given an objective of "maintain," For any species listed under SARA or under provincial/territorial endangered species legislation, Bird Conservation Strategies defer to population objectives in available Recovery Strategies and Management Plans. If recovery documents are not yet finalized, objectives are set using the same approach used for the other priority species within that bird group. Once recovery objectives are available, they will replace the interim objectives identified in this strategy.

Shorebirds and Landbirds

Population objectives for landbirds in this strategy (other than for those at risk) were based on objectives published in the Ontario Partners in Flight (2008) plan, which were derived primarily from counts on the Breeding Bird Survey. Ontario landbird objectives differ from those presented in the continental landbird plan (Rich et al. 2004). Continental goals reflect a return to levels of the late 1960s for species of Concern or the 1990s for Stewardship species. In contrast, population objectives in Ontario Partners in Flight (2008) reflect maintenance or restoration of populations to values within the ERNV. These objectives assume a link between abundance and habitat supply, and acknowledge that variability in habitat condition and supply is a natural characteristic of the forested habitats of BCR 12 ON.

Population objectives were not set for shorebird species that do not breed in BCR 12 ON. Objectives for these more northerly breeding species are provided in strategies for other BCRs (notably BCR 3). Among the six species that do breed in the region, the American Woodcock is a harvested species and is surveyed by a dedicated monitoring program that provides a sound basis for development of population objectives (Kelley et al. 2008). The objective for this species reflects a return to 1970s levels. The Piping Plover (*circumcinctus*) is a species at risk, and population objectives are provided in recovery documents. For the remaining four species, there are no established national population objectives. The qualitative objectives provided here reflect a reversal of the trends observed in the best available monitoring data (Breeding Bird Survey, Ontario Breeding Bird Atlas, or Ontario Shorebird Survey).

Waterfowl

Population objectives for waterfowl are taken from the Ontario Eastern Habitat Joint Venture Implementation Plan (2007) and the Management Plan for Temperate-breeding Canada geese in Ontario (Environment Canada, in prep.). For this BCR, population goals were not established for migrant waterfowl. This differs from BCR 13 in Ontario, where regular staging surveys of the nearshore waters of the Great Lakes provide the monitoring information necessary to establish and track progress towards objectives for migrants. For breeding species, population goals for BCR 12 ON are derived from the Eastern Waterfowl Survey, which has been flown across Eastern Canada since 1990.[12] The goals reflect the mean of the top three population counts from the surveys during the period 1996 to 2005 (for many species, these occur between 1999 and 2002) (Bolduc et al. 2008). The population goal for Canada Geese, Eastern Temperate-breeding population reflects a desire to maintain the population size between 40 000 to 80 000 indicated breeding pairs (IBP) based on a four-year average as measured by the Southern Ontario Waterfowl Plot Survey.

Waterbirds

Population objectives for waterbirds were based on observed population trends (Zeran et al. 2009) and/or the species' conservation status (e.g., listed as a species at risk or ranked as provincially rare), as described in Table A2. Regionally specific population trend data from the

[12] The western portion of BCR 12 ON is not covered by the Eastern Waterfowl Survey.

Ontario Breeding Bird Atlas, the Ontario Breeding Bird Survey, the Great Lakes Marsh Monitoring Program, and the Great Lakes Colonial Waterbird Monitoring Surveys (decadal census and annual surveys) were used where available.

Table A2. Relationship between waterbird population trend assessment and generic population objectives.

Population Trend and/or Conservation Status	BCR 12 ON Strategy Population Objective
Biologically significant population decline	Increase
Apparent population decline	Maintain current
Apparent population decline AND S4-S5*	Assess /Maintain
Apparently stable population	Maintain current
Apparent population increase	Maintain current
Apparently stable population OR Apparent population increase AND S1-S3*	Assess/Maintain
Biologically significant population increase	Maintain OR Decrease
Information Lacking or Information Unreliable/Unknown	Assess/Maintain
Species at risk	Recovery Objective

* Provincial (or regional) ranks are used by the Ontario Natural Heritage Information Centre to set protection priorities for rare species and natural communities. These ranks convey the degree of rarity of the species or community at the regional level and are not legal designations.
S1 Critically Imperiled–Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
S2 Imperiled–Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
S3 Vulnerable–Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4 Apparently Secure–Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5 Secure–Common, widespread, and abundant in the nation or state/province.

Element 4: Threat Assessment for Priority Species

Bird population trends are driven by factors that affect reproduction and/or survival during any point in the annual cycle. Threats that can reduce survival include, for example, reduced food availability at migratory stopovers or exposure to toxic compounds. Examples of threats that can reduce reproductive success may include high levels of nest predation or reduced quality or quantity of breeding habitat.

The threats assessment exercise included three main steps:

1. Conducting a literature review to itemize past, current and future threats for each priority species and classifying the threats following a standardized classification scheme (Salafsky et al. 2008).
2. Ranking the magnitude of threats for priority species following a standardized protocol (Kennedy et al. 2012).
3. Preparing a set of threat profiles for the BCR subregion, for broad habitat categories.

Each threat was categorized following the International Union for Conservation of Nature – Conservation Measures Partnership (IUCN-CMP) threat classification scheme (Salafsky et al. 2008) with the addition of categories to capture species for which we lack information. Only threats stemming from human activity were included in the threats assessment because they can be mitigated; natural processes that prevent populations from expanding beyond a given level were considered and noted, but no actions beyond research and/or monitoring were developed. Threats were ranked by assessing the scope (the proportion of the species' range within the subregion that is affected by the threat) and severity (the relative impact that the threat poses to the viability of the species' populations) of the threat. The scores for scope and severity were combined to determine an overall magnitude low, medium, high or very high. These magnitudes were then rolled up by threat categories and sub-categories across habitat types (see Kennedy et al. 2012 for details on this process). The threats roll-up allows for comparison of the relative magnitude of the threats among threat categories and habitat types. The scoring and ranking of threats not only helps to determine which threats contribute most to population declines in individual species, but also allows us to focus attention on the threats with the greatest effects on suites of species or in broad habitat classes.

For this strategy, threats were identified through literature reviews, including the existing bird conservation plans for BCR 12 ON: landbirds – Ontario Partners in Flight (2008); waterfowl – Ontario Eastern Habitat Joint Venture (2007); waterbirds – Zeran et al. (2009); shorebirds – Ross et al. (2003) and local expert opinion Wedeles and Mainguy (2010). Supplementary data from Cadman et al. (2007), Poole (2009), Sandilands (2005; 2010) and COSEWIC species assessments and various species accounts from the Birds of North America Online (Cornell Lab of Ornithology 2013) were also used. Published recovery documents were consulted to compile threats for species listed under the federal SARA or Ontario's *Endangered Species Act 2007*. Each threat was categorized following the IUCN threat classification scheme. Only threats stemming from human activity were included in the threats assessment because they can be mitigated; natural processes that prevent populations from expanding beyond a given level were considered and noted, but no actions beyond research and/or monitoring were developed.

In BCR 12 ON, category 12 "Other direct threats" and sub-category 12.1 "Information lacking" was used to identify priority species that lack adequate biological or demographic information required for population conservation and management. Using this category in this manner facilitated the development of targeted research and monitoring conservation actions to address knowledge gaps for these species, but unlike the other threats, they were not ranked.

Element 5: Conservation Objectives

Overall, conservation objectives represent the desired conditions, within the subregion that will collectively contribute to achieving population objectives. Objectives may also outline the research or monitoring needed to improve the understanding of species declines and how to best take action.

Currently, most conservation objectives are measurable using qualitative categories (e.g., decrease, maintain, increase) that will allow an evaluation of implementation progress, but they are not linked quantitatively to population objectives. Implementation that incorporates an active adaptive management process is an underlying principle of this conservation effort and will allow for future evaluation of whether or not reaching conservation objectives contributed to achieving population objectives.

Whenever possible, conservation objectives benefit multiple species, and/or respond to more than one threat. However, where necessary, they focus on the specific requirements of a single species.

Conservation objectives generally fall into one of two broad categories:

- habitat objectives within the BCR subregion (the quantity, quality and configuration of priority habitats)
- non-habitat objectives within the BCR subregion (minimizing mortality by reducing predation, conducting education and outreach to reduce human disturbance, etc.)

Ideally, habitat objectives would reflect the type, amount and location of habitat necessary to support population levels of priority species outlined in the population objectives. Currently, there is a lack of data and tools at the BCR scale to develop these specific quantitative objectives. Threats-based objectives present the direction of change required to move toward the population objectives using the best available information and our knowledge of ecosystem management strategies within broad habitat types.

Element 6: Recommended Actions

Recommended conservation actions are the strategies required to achieve conservation objectives. Recommended actions are usually made at the strategic level rather than being highly detailed and prescriptive. Actions were classified following the IUCN-CMP classification of conservation actions (Salafsky et al. 2008) with the addition of categories to address research and monitoring needs. When possible, more detailed recommendations can be included, for example if best management practices, ecosystem plans or multiple recovery documents are available for a subregion. However, actions should be detailed enough to provide initial guidance for implementation.

The objectives for research, monitoring and widespread issues may not have actions associated with them. These issues are often so multi-faceted that actions are best designed in

consultation with partners and subject-matter experts. Implementation teams will be better positioned to address these complex issues, drawing input from various stakeholders.

Recommended actions defer to or support those provided in recovery documents for species at risk at the federal, provincial or territorial level, but because these strategies are directed at multiple species, actions are usually more general than those developed for individual species. For more detailed recommendations for species at risk, readers should consult recovery documents.

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